

DIATHERMY THERAPY

FIFTH
REVISED
EDITION



Published By
RESEARCH DEPARTMENT

H·G·Fischer & Company, Inc.
Physical Therapy Headquarters
2323-37 Wabansia Avenue
Chicago, Illinois

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*Fifth
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Preface

Owing to the comparative newness of electrical apparatus for the production of diathermic energy, it has not heretofore been possible to establish standard technics applicable to the treatment of the various conditions in which diathermy is indicated. Appreciating the need of such a standard, especially among medical men who are just entering the physiotherapeutic field, we have attempted in this publication insofar as possible to supply this much needed information.

Most of the physicians and surgeons using diathermy are pioneers in the field, and employ whatever technic they, through experience, have found gives the best results. These men have adopted procedures that may be regarded as standard. We find that the successful men, even where widely separated, have come to use practically the same general technic in their work, and in the preparation of this book of therapy, we have been careful to incorporate only that which has been adopted by a sufficient number of physicians as safe, reliable, and efficient.

While diathermy as an electrical modality is as nearly a constant element as influence of altitude, latitude, and fluctuations of line current will permit, the reactions of the human body differ widely in different individuals. Furthermore, the same individual does not react the same at all times, and in the use of diathermic energy, as in the administration of medicines, the physician must use both caution and judgment, study each case individually, and adjust his technic to suit conditions.

Neurotic patients often have an extreme fear of any electrical modality, which they associate with electrical shock and high tension burns about which almost everyone has some knowledge. In treating such patients, the operator must endeavor to inspire their confidence by his attitude and make them understand that he is not carrying out an experiment, but that he knows exactly what he is doing and is confident of the results to be obtained. He

should also check his connections, the application of the electrodes, the setting of the machine and all possible sources of error before starting the treatment.

While diathermy is doubtless as safe as any agent used in the practice of medicine and surgery, it is possible to abuse it and produce burns, or uncomfortable sensations to the patient. We have endeavored, in this book, by furnishing reliable information regarding the application of this physical agency, to eliminate such unfortunate results.

It is our hope that by the publication of this Book of Therapy we will aid in the advance of physical and medical science, and will smoothe the way for the beginner in physiotherapy.

Research Department,
H. G. FISCHER & CO., Inc.

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NOTE—All indications and treatments are arranged *alphabetically*, which makes the section of Diathermy Therapy *self-indexing*.

Medical Diathermy

Diathermy, the latest development and unquestionably the most useful of physiotherapeutic agents, is used in two distinct forms; medical or constructive diathermy, and surgical or destructive diathermy; i. e., the dividing-line being located at the juncture where stimulation ceases and disintegration begins. Both varieties are generated in the same manner, but the methods of application and amounts of energy used differ widely, so both types will be described separately.

All elements offer some resistance to the flow of electricity. The heat produced by this resistance is proportional to the resistance, to the density (volts times milliamperes) of the current, and the time during which the current is applied.

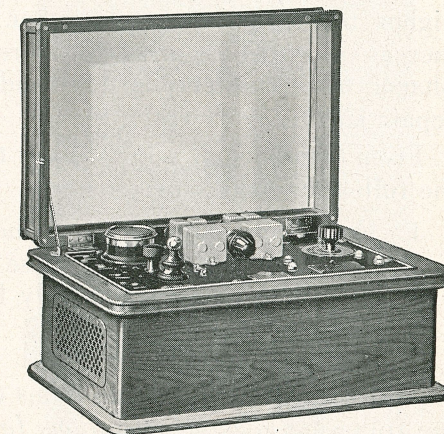
The human structure is made of varied resistances, and the heat developed in any part depends upon the various resistances thru which the current is forced.

The problem then is to find a current which will not lead to electrolysis, which results in disintegration of bodily structures; a current which will have no other effect than that of heat.

This is achieved by employing currents with quick reversion of polarity, running into many thousands of alternations per second, and having sufficient voltage to force the milliamperage thru the various resistances encountered.

Medical diathermy is applicable in all instances in which the therapeutic effects of heat on or within the tissues is beneficial.

The ability to generate the heat *within* the tissues is the paramount advantage of Diathermy over any other method. Heat applied to the surface of the body by means of a hot water bag or an electric pad penetrates to a very limited depth only, and cannot be regulated.



Fischer Hospital Portable Diathermy Unit,
Type "G2"

Medical Diathermy—Continued

With the help of Diathermy we are in a position to administer heat wherever it is desirable, and to any area superficially or to any required depth. The degree of heat produced may be gauged and regulated within any limits desired.

The physiological effects of diathermy in medical doses are as follows: When using very weak currents there is an initial stimulation of all contractile tissue, resulting mainly in vasomotor stimulation. However, this occurs only with currents much smaller than those used therapeutically. In practice, the initial stimulation is followed by a secondary paralysis, or relaxation of all contractile elements in the tissue, the chief consequence of which is vasomotor relaxation.

This means an increase in the calibre of the arterioles, and an increased blood-supply to the part. An increase in blood-supply is after all the chief therapeutic weapon with which we attack most localized conditions. It means increased nutrition, increased oxygenation, better elimination of waste and toxic products, better supply of various specific substances that are locally required; better drainage of edematous areas.

There is furthermore a relaxation of all other tissue elements, so that spasmodic muscles are relaxed, painful pressures and tensions on nerves are relieved, thereby providing relief for many forms of local pain.

Finally, all chemical reactions take place more rapidly, the higher the temperature. In other words, local metabolism is increased; nutrition proceeds more rapidly at the spot, as do phagocytosis, antibody action, and all processes concerned in repair and recovery from disease.

From the above, it would follow that diathermy is beneficial in the following conditions:

1. Conditions requiring local increase of blood supply;
2. Conditions requiring increase in rate of metabolism, oxidation, phagocytosis, antibody formation, action, etc.
3. Increase of elimination.
4. Production of relaxation.

Translating the above into terms of general pathology, we have the following *general indications for medical diathermy*:

1. Chronic local debilitated conditions
2. Chronic inflammations
3. Acute inflammations

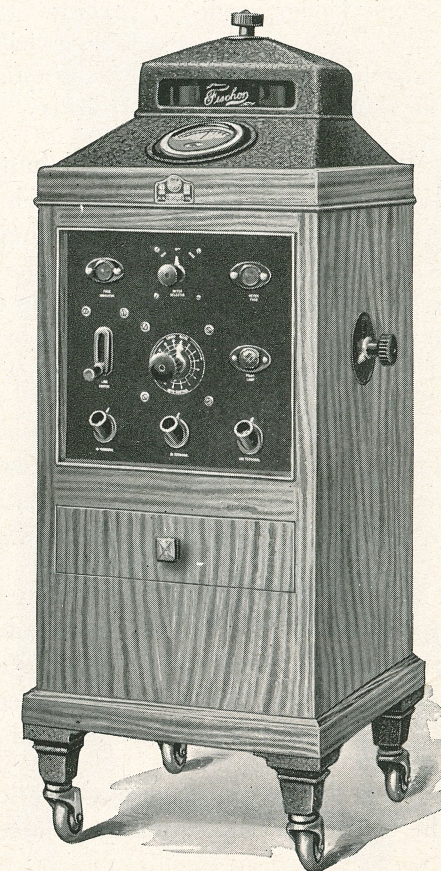
Medical Diathermy—Continued

4. Toxic states
5. Neuroses.

Examples of these conditions are as follows:

1. Chronic ulcers, especially varicose ulcers; eczema, the dry, scaly form; non-united fractures; trophic sores; chronic arthritis; muscular atrophy, etc.
2. Tuberculosis, pulmonary, bone, and gland; urethritis, prostatitis; metritis, cervicitis, salpingitis; otitis media; osteomyelitis; neuritis.
3. Pneumonia; pleurisy; orchitis; arthritis.
4. Nephritis; fevers; acidosis.
5. Idiopathic hypertension; psychoses, autonomic imbalance.

By the employment of properly sized and shaped electrodes and the proper technic, we are able to deliver to areas of any size, not only greatly varying degrees of heat, but accurately measured dosage. This heating may be generally concentrated or localized to small sections by simply varying the technic of application. The result is accomplished with no sense of shocking or so-called electrical sensations on the part of the patient; in fact, the patient should never feel any other sensation than that of the required warmth.



Model "V" Senior Diathermy Cabinet

Medical Diathermy—Continued

Briefly, medical Diathermy produces internal heating (or what we might term an internal poultice), offers relief of venous and visceral congestion, creates capillary hyperemia, has marked analgesic properties, stimulates cells, glands and the vasomotor nerves, and is used to exceptional advantage in:

Pneumonic infiltrations	Neuritis	Chronic urethritis
Industrial injury cases	Ankylosed joints	Gonococcal infection
Post-operative adhesions	Lumbago	Traumatic injuries
Absorption of callous and deposits	Neuralgias	Pelvic inflammation
Chronic kidney conditions	Sciatica	Angina pectoris
Congestion of liver	Myalgias	Muscular atrophy
Old skin fibrosis	Orchitis	Bronchial congestion
	Endocervicitis	And for the relief of pain
	Epididymitis	
	Arthritis	

It is impossible to give a definite list of conditions for which diathermy is available. Any such list, however long, would be sure to lack completeness. Diathermy is of value wherever heat is indicated. The only way for the prospective user of diathermy to learn how to apply it, is to keep in mind its general effects, and to keep in mind the indications in his patients for these effects. If he does that, he will discover new uses for diathermy every day.

Diathermy applications are bipolar,* and while on first observance the general technic seems exceedingly complicated, it is in reality very simple. Proper attention must be paid to the seemingly small details of an average diathermy application, of course.

Diathermy dosage will naturally vary from as low as 100 M. A. up to as high as 2500 M. A. and over, to correspond with the type of case under treatment as well as the square inch surface area of the electrodes. There is an accepted rule that 500 M. A. for each 7 square inches of surface covered should not be exceeded.

Start the treatment with a very low milliamperage, that is, with the spark interrupter points adjusted almost but not quite closed,

* Bipolar—From 2 terminals.
Unipolar—From a single terminal.

Medical Diathermy—Continued

and increase the current gradually to the desired maximum, holding the current volume at that point for the duration of the treatment and then gradually reducing again to zero before throwing off the current. This will produce a thorough and even heating in the tissues.

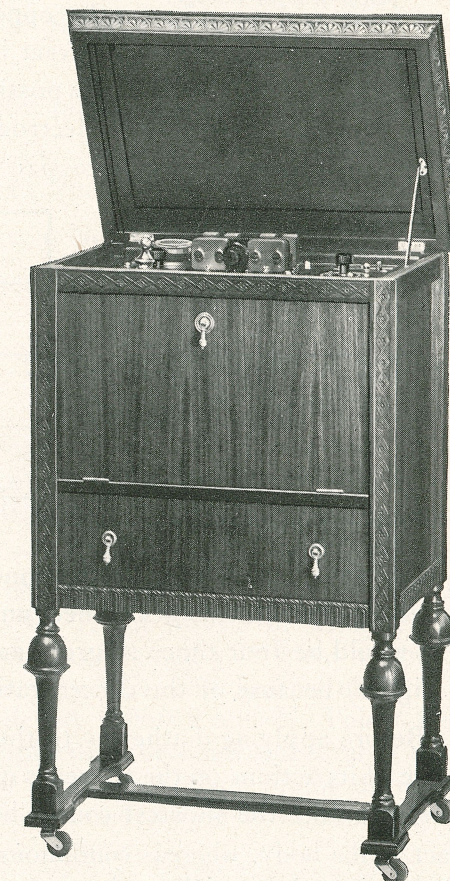
Medical diathermy produces converse heat. Where it is desired to warm any certain section of the body, place electrodes opposite each other, which electrodes should be of such size as indicated by the area involved and of equal size if a general heating through is desired, or of carefully computed dimensions if the heating is to be localized nearer to one surface than the other.

Diathermy Don'ts

Do not use where there has been hemorrhage or where there is a possibility of one (tuberculosis, uterine disease, peptic ulcer, etc.), except with proper caution.

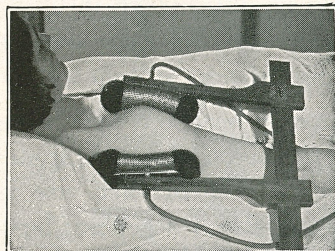
Do not use within 24 hours of menstruation nor in pregnancy.

Do not use where there is undrained suppuration or infected fluid under pressure, as septicemia may result; boils, abscesses, carbuncles, suppurating joints, purulent gall bladder, purulent head sinuses.



Fischer Model G-3 Diathermy Cabinet

Effects of Diathermy Currents



Diathermy Clamp Applied to the Shoulder. Heating effect is apparent straight through.

When electrodes of equal size are applied to opposite sides of a limb or trunk, the heating effect will be apparent straight through with temperature increase at the center (note illustrations on following pages). By using a large electrode on one side and a small electrode on the opposite side, the intensity of the resultant heat will be in exact inverse ratio of the square inch area covered. It is easily possible to concentrate so much heating under a very small electrode as to produce actual coagulation. Note the relative size of these squares:

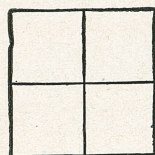


Fig. A

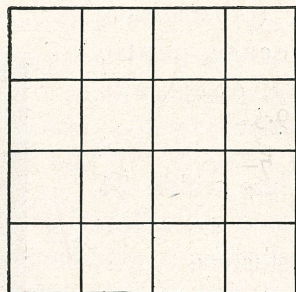


Fig. B

If electrodes of such proportions were placed on opposite sides of a limb, the heating effect under the four squares (Fig. A) would be four times as great as under the sixteen squares (Fig. B) because of the concentration of energy.

Before applying diathermy to the human body some knowledge of its actions on the tissues is quite necessary. Diathermy currents take the shortest course between two points of contact in the body, whereas continuous currents (as for example, Galvanic,) always follow the path of least resistance.

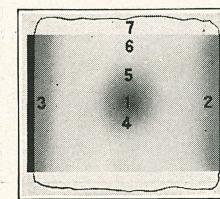


Fig. 1

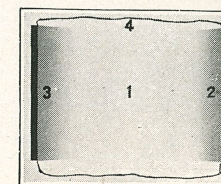


Fig. 2

Figure No. 1 illustrates effect of heating when applying electrodes of equal size to opposite sides of a piece of beef.

Volume of current used 700 milliamperes for first 5 minutes, followed with 1000 milliamperes for 3 minutes.

Point 1 showed highest thermometer reading—105.5° F.*

Point 2 with thermometer placed in meat 1/2 inch from electrode—102.5° F.

Point 3 with thermometer placed in meat 1 inch from electrode—101.5° F.

Point 4 about 1 inch from No. 1—101° F.

Point 5 about 2 inches from No. 1—100° F.

Point 6, thermometer set just within path of crossing current—99.5° F.

Point 7—no heating. Temperature remains normal outside of path of current.

This does not exactly hold true where living tissue is being treated, on account of the circulation of the blood and the varying densities and resultant resistances of the muscle, bone, etc.

Figure No. 2 illustrates effect of heating when applying electrodes of equal size, as in No. 1, but instead of using a small amount of current and increasing gradually, a great volume of current was used right at the start. The only heating effect is immediately under the electrodes at points 2 and 3. Points 1 and 4 remain normal. This application becomes unbearable to the patient before any good can result, on account of the drying out of the surface with resultant increased resistance and burning sensation at points of contact.

* See note at bottom of page 12.

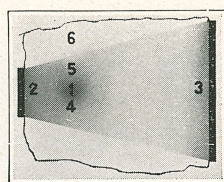


Fig. 3

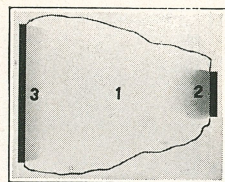


Fig. 4

Figure No. 3 illustrates effect of heating when applying electrodes of unequal size, in this instance, a 5 inch circular disc on one side of a piece of beef, and a 2-inch on the other.

A moderate current, only, was used at the start—500 milliamperes for 5 minutes, increasing to 750 milliamperes for an additional 5 minutes.

Point 1 showed a thermometer reading of 105° F.*

Point 2, with thermometer $\frac{3}{4}$ inch from smaller disc— 103° F.

Point 3, with thermometer $\frac{3}{4}$ inch from larger disc— 99.5° F.

Point 4, with thermometer $\frac{3}{4}$ inch from No. 1 showed a reading of 102° F.

Point 5, with thermometer $1\frac{1}{2}$ inches from No. 1, showed a reading of 101° F.

Point 6, this section remained normal.

Figure No. 4 illustrates effect of heating when applying electrodes of unequal size, as in No. 3, when using 900 milliamperes right from the start.

Practically all of the heat concentrated at point 2, under the smaller disc, the thermometer registering 110° F. at the end of 10 minutes.

Heating at point 1 was negligible because of the resistance of the outer surface at points 2 and 3, due to the too sudden application of current and resultant burning.

The current was then increased to 1500 milliamperes for 7 minutes and then 2000 M. A. for 5 minutes additional. The meat was thoroughly cooked at points 1 and 2, especially so under the smaller disc, and blanched considerably at point 3, but the temperature did not exceed 110° F. at a distance of 2 inches from point 1.

*In living tissue, radiation affects the outer portions of the field, while the central areas which radiate into tissues already heated, naturally are warmest.

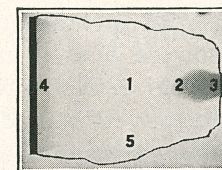


Fig. 5

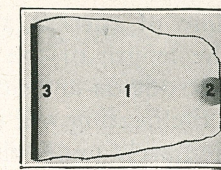


Fig. 6

Figure No. 5 illustrates the application of one 5-inch disc and one of 1-inch, only, to opposite sides of a piece of beef. Only moderate current was used, starting at 300 milliamperes and increasing gradually to 600.

Points 1 and 2 showed increase to 100° F. only.

Point 3 showed a reading of 106° F.

Point 4 showed temperature increased to 102° F.

Point 5 showed no perceptible increase from normal.

Figure No. 6 illustrates the application of unequal sized electrodes as under No. 5, but with 700 milliamperes used to start.

Heating was increased to 108° F. at point 2, to 100° F. at point 3, and remained normal at point 1 because of the resistance of the surface at point 2, due to the too sudden application of current and resultant burning under this smaller disc.

It is to be understood that if these tests were being made upon living flesh with the blood stream coursing, that point 7, in figure No. 1, and point 4, in figure No. 2, point 6, in No. 4, and point 5, in No. 5, would not have remained at normal temperature, but there would have been some rise in temperature because of heat conduction at these points.

On the other hand, starting the treatment with a great volume of current abruptly, practically all of the heating will concentrate near the surface right under the electrodes, with a resultant drying out of the conducting materials that you have applied (soap lather, etc.,) as well as the skin itself. Your patient will be uncomfortable and will complain of pricking sensations. This latter condition is to be avoided in all cases.

This theory also holds true up to a certain point when using electrodes of unequal size. Starting treatment with a moderate current and gradually increasing the volume will produce a result about as indicated in figure No. 3.

Increasing the volume of current too rapidly will cause heating under the surface of the smaller electrode as in figure No. 4, and in just a minute's time the sensation will have become unbearable to the patient.

The volume of current as measured in milliamperes will determine the length of the cone-shaped heated area, except when the electrode on one side is a great deal smaller than the other, when the heating will concentrate very noticeably at the surface immediately under the smaller contact.

Bone offers greatest resistance to the passage of diathermy; tissue and moist skin offer very little resistance. Muscle and bone retain the heating from the diathermy treatment for hours, while most of the skin heating is dissipated by radiation; and the tissues immediately beneath the skin lose most of the heat through conduction by the dilated blood vessels.

To recapitulate: The following factors must be considered in giving a diathermy treatment:

- Resistance of the skin
- Amount and character of tissue between electrodes
- Moisture of tissues
- Density of tissues
- Amount of circulating blood supply
- Distance between the electrodes
- Size of the electrodes
- Tolerance of the patient
- Voltage and milliamperage employed
- Degree of temperature desired.

We repeat another important point. The heating effect under an electrode 2 inches square will be four times as great as under an electrode 4 inches square, that is, with the same setting of the machine. By doubling the milliampere reading, say for example, from 500 to 1000 M. A., we actually increase the heating effect by four times.

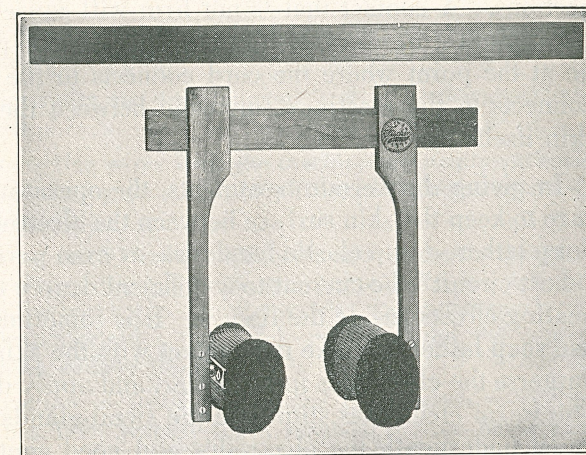
A Diathermy electrode, as well as electrodes for the administering of any other electrical modality to the human body, should be of bare metal. This metal may have a backing or support of a flexible material, as for instance, a soft rubber sponge, but the point we wish to emphasize is that the element in direct contact with the skin should be metal and not some absorbent material. Absorbent padding soaked in brine or other conducting medium, may be employed, but there is always danger of such electrodes drying out during the treatment and losing their conducting value. There is even greater danger of blistering by steam, and it has been found that a water-soaked electrode of say, 3 x 6 inches, which has 18 square inches of surface area, would be active only for probably 6 square inches at the end of a 10-minute treatment, the fluid having all gone to one end instead of being evenly distributed.

Diathermy Electrodes

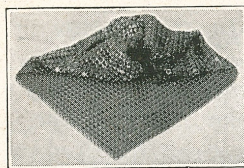
We recommend two types of metal electrodes—German silver, flat link mesh for all uneven surfaces, over the shoulder, joints, etc., and sheet block tin for flat surfaces. Such metal electrodes, as well as the surface of the skin at the point of contact, must be well covered with a thick soap lather, something on the order of a good shaving soap (we hear quite often that ordinary Ivory soap makes an excellent medium). Before applying the metal diathermy electrodes to the skin, cover both thoroughly with the soap lather, and as quickly as possible bind the electrode in place.

On the limbs, the electrodes are generally held from slipping with elastic bandage, wound around just tight enough to hold the electrode but not so tight that the natural swelling of the limb as a result of the heating will produce any constriction (as for example, an ischemia.) Since the regular elastic bandages are easily soiled, are spoiled by laundering, and are quite expensive, many operators make use of crepe paper bandages; these are quite satisfactory, and can be discarded after being used once.

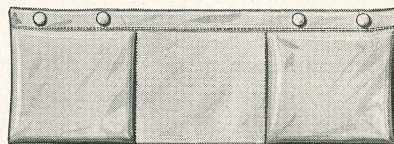
The diathermy clamp is invaluable in many applications. Is instantly applied or removed; never short-circuits; may be used with any size of mesh covered sponge electrodes. A polished wood bar supports two sliding arms, also of wood, which hold the electrodes firmly in place.



The Diathermy Clamp



Flexible Mesh Electrode



Sand Bag

Sandbags are invaluable for holding electrodes in place on the trunk, and very often on the limbs, and several sizes and shapes of sandbags should always be available in the diathermy room.

Never fail to determine the size and shapes of your electrodes, carefully. The indifferent electrode, that is on the opposite part of the body from which the greatest heating effect is desired, should always be of liberal size. There is no advantage in making your indifferent electrodes too small.

Never permit poor contacts or loose connections. Fully 90 per cent of all complaints as a result of diathermy treatments are the direct result of either improperly applied electrodes, or poor connections. A contact that is not firm will cause a prickling, burning sensation in every instance. This lack of proper contact may be at the point where the cord connects to the machine, where it connects to the electrode, or, even between the electrode and the skin itself.

In giving diathermic treatments, the operator must use extreme care to keep the skin surface between the electrodes absolutely dry. Soap lather, damp elastic bandages, or even perspiration will often "short-circuit" the current to a sufficient degree to produce unequal heating effects inside the tissues. It is sometimes advisable not to use soap lather to make the contact with the skin, and in this case, immerse the electrodes in hot water, and apply directly to the skin. The warm electrodes stimulate the sweat-glands, the skin becomes moist underneath the electrodes and good contact may be established. The only requirement is that the electrode be in contact with the skin at all points, as a space underneath any part of the electrode will produce sparking and discomfort to the patient.

Current volumes, duration of treatments and frequency of treatments will depend, naturally, on the type of treatment and the nature of the case. We will endeavor on the following pages to offer some assistance along this line.

It is very important to keep the patient's confidence at all times. To that end, work carefully, slowly, and methodically, in order to avoid making little slips; an accidental spark that to you may seem trivial, will fill the patient with terror, especially if it is a woman.

Especially, if a long series of treatments will be required, it is more important that the patient leave the treatment room after the first treatment with confidence in the doctor and in his apparatus, than that a great deal of therapeutic progress should have been made at the expense of terrifying the patient and running the risk of his or her never returning. Many operators term their first treatment a "placebo" treatment and give it for the purpose of accustoming the patient to the routine.

Important Points in General Technic in Medical Diathermy

1. Have your diagnosis accurately in mind.
2. Have a definite idea as to how your treatment is expected to work.
3. Decide just where the maximum heat must be applied, and arrange the size and position of the electrodes to get it there.
4. Decide whether the heating is to be mild, moderate, or intense, and plan the current intensity accordingly.
5. See that the electrodes are well lathered, and in even contact, and firmly held to the part.
6. See that the connecting wires from the machine are firmly anchored and in no danger of becoming loosened, or pulling the electrodes out of position during the treatment.
7. Begin with a very feeble current intensity, and increase very gradually to the desired amount, taking several minutes to reach it. Advance the control lever and the spark gap simultaneously; too much spark gap makes the patient uncomfortable; too much volume from the control lever works the machine inefficiently.
8. Err in the direction of insufficient rather than excessive current until the treatment has been several times repeated. Skin burns take long to heal, leave scars, and interfere with future treatments.
9. Do not destroy the patient's confidence by careless handling of things during the first treatment.
10. Do not leave a timid patient alone at the mercy of the machine; leave an attendant on watch, or arrange a switch so that the patient can shut off the current in case something seems wrong.
11. Do not apply diathermy over enclosed pus and fluid under pressure.

Surgical Diathermy

Surgical diathermy is the term given to the application of high frequency currents for the destruction of tissues by the heat produced through resistance offered by the tissues through which the current is passed.

This method differs from all other applications of heat to the body, in that instead of the heat being sent inward from the outer surface as is the case when employing a cautery knife or hot iron (electrically or otherwise) the heat is generated within the tissues. The temperature at the point of contact of the active electrode is raised to the point of coagulation.

In surgical work the aim is to produce concentrated heat at small areas via the needle, the knife or special electrodes of various shapes, for the immediate removal of tissue—for coagulation and sloughing, for sealing blood vessels. These can all be accomplished with lessened danger of transplantation of bacterial elements by diathermy than any other known method.

Electro-coagulation is used to advantage in malignancies, in fact, it is superior to other methods in that what would be otherwise inoperable growths are successfully destroyed; the blood and lymph coagulate, the vessels are sealed and infecting organisms destroyed.

Tissues or growths to be destroyed by electro-coagulation must be accessible; that is, the active electrode must be placed in actual contact.

The major advantages of surgical diathermy, or, as we shall term it hereafter in this publication, "electro-coagulation," follow:

Tissues are coagulated to any desired depth.

Operations are bloodless and leave sterilized wounds.

The blood and lymph channels are sealed, lessening the danger of metastasis in cases of malignancy.

Tumors otherwise inoperable may be safely removed.

Electro-coagulation is used to advantage in:

Destroying growths and infective granulomata of the skin and mucous membrane of the mouth, nose, pharynx, tongue, larynx and oesophagus.

Cancerous conditions—sarcoma, and carcinoma.

Destruction of diseased tissues and benign new growths.

Surgical Diathermy—Continued

Tumors of the uterus and bladder.

Vascular tumors.

Chronic and malignant ulcerations.

Superficial lesions—Warts, moles, naevi.

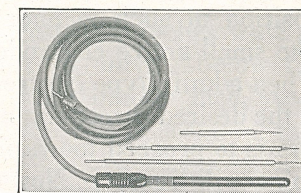
Keratosis.

Electro-coagulation is similar to medical diathermy in the fact that it is bipolar, that the same currents from the high frequency machine are employed, and that heat alone is the agent.

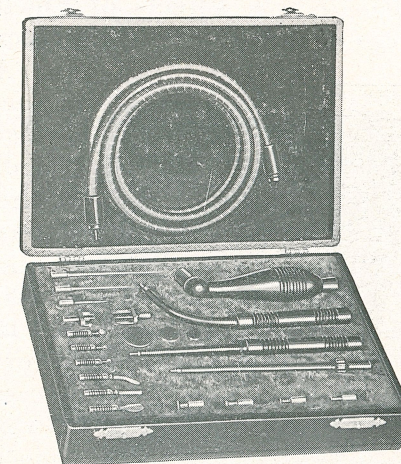
In administering medical diathermy we employ heat within physiological limits, while with electro-coagulation, the current is concentrated on the small electrode and the tissues are heated to a point where coagulation occurs. We will refer in the following copy to *active* and *indifferent* electrodes.

The active electrode is the small point or disc which is placed in direct contact with the diseased tissue, or the tissue to be removed, or it may be a needle, either single or multiple, or any size of small disc, fastened to an insulated handle. The indifferent electrode is usually a large metallic plate to cover a large area of skin surface (large enough so that there will be no danger of destroying healthy tissue), which is placed on the body somewhere adjacent to the point of operation.

For the removal of some growths a piece of metal tubing is held in the patient's hands as the indifferent electrode, but this method meets with little approval. The skin under the indifferent electrode will become only slightly warm because of the large surface covered, as compared to the extreme destructive heat at the point of contact of the active electrode which is so very much smaller in area.



Needle Point Electrodes and Holder.



Set of Surgical Diathermy Electrodes in Special Case

Surgical Diathermy—Continued

The indifferent electrode is of sheet block tin, and should be liberal in size, preferably 8 inches square (or round), or larger. This indifferent electrode is to be coated with thick soap lather, and the surface of the skin where it is to be placed is also coated with this material, insuring the best of contact with a minimum of electrical resistance. If plain or salt water is employed as a softening or conducting medium, scalding may result.

When employing electrocoagulation the nature of the case in hand and the character of the parts involved will aid in determining whether the direct contact method as described in the foregoing, or keeping the active electrode at a distance from the growth and sparking, is desired. The latter produces a rapid coagulation which is quite superficial, and is preferable for small superficial lesions.

The indifferent electrode must be bound or held in the desired position in such manner that it cannot move during operation. The small active electrodes are rarely moved with the current on. When a knife type electrode is employed it may be moved slightly in the desired direction, but the tendency on the part of most operators is to proceed too rapidly, and insufficient coagulation at some point will result. Never attempt to hurry electro-coagulation. Proceed slowly and methodically and be assured of finished results, paying more attention to the blanching of the tissues than to the reading on the milliamperage meter.

Effects of Electro-Coagulation

Illustration No. 1.



Fig. 1

A piece of lean beef, 2 inches square and 3 inches thick, was placed on a flat metal sheet as the indifferent electrode. The $\frac{3}{4}$ inch circular disc (catalog No. 1323) was placed in firm contact with the center of the top and a current of 700 milliamperes was passed for 1 minute, followed with 1200 M. A. for another minute. Result:—An evenly coagulated mass of tissue, white in appearance, extending 1 inch on the surface and $\frac{1}{2}$ inch deep. No evidence of burning or charring.

Surgical Diathermy—Continued

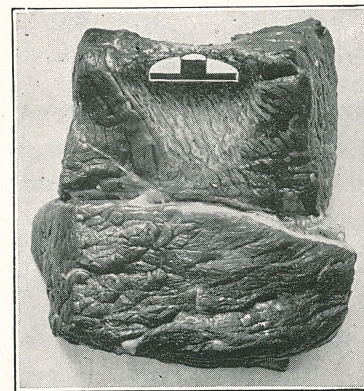


Fig. 2



Fig. 3

Illustration No. 2.

The $\frac{3}{4}$ inch disc was placed in contact, as above, with another piece of beef, and approximately 4000 milliamperes passed for one full minute. Result:—A charred crust $1\frac{1}{8}$ inches wide on the surface, and extending down almost $\frac{1}{4}$ inch. Below this hardened section was a coagulated mass down another inch, tapering off in a cone shape.

Illustration No. 3.

A larger piece of beef measuring $3 \times 3 \times 2\frac{1}{2}$ inches was used in this experiment. The 5-pronged multiple needle electrode was forced down into the center until the flat section rested on the meat proper, and 1100 milliamperes passed for $\frac{1}{2}$ minute, followed with $\frac{1}{2}$ minute of 2000 M. A. Result:—An evenly coagulated white appearing mass of tissue, extending $1\frac{3}{8}$ inches deep and $1\frac{1}{8}$ inches wide. No charring.

Illustration No. 4.

A piece of fresh lean beef $2\frac{3}{4}$ inches square by 2 inches deep was placed on the indifferent electrode, and the single needle No. 1308 plunged 1 inch down from the top. A heavy current of 2300 milliamperes was passed for 1 minute. Result: A burned mass, charred black where the electrode had made contact, and thoroughly cooked clear thru to the bottom and $\frac{7}{8}$ inch wide.

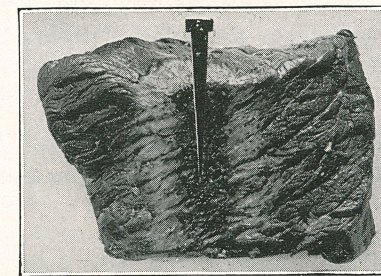


Fig. 4

Surgical Diathermy—Continued

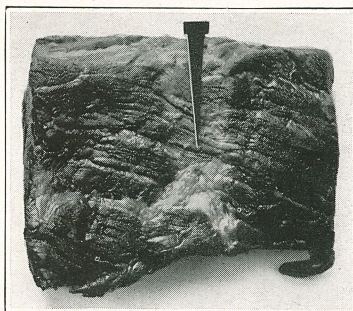


Fig. 5

Illustration No. 5

The same size piece of beef was used as described under figure 4, and the same electrodes. Current was turned on more gradually—starting at 600 milliamperes for $\frac{1}{2}$ minute, followed with 900 M. A. for the same length of time. Result: An even coagulation, $\frac{5}{8}$ inch wide and 1 inch deep. No char-

ring, and the line of coagulated tissue clearly defined.

Electro-Coagulation Cautions

1. Be sure that indifferent electrode is properly applied, firmly fixed so that it cannot move, and good connection made.
2. If ether anesthesia, or other inflammable gas, is used be sure that it is a safe distance from the field of operation. Do not use a high frequency machine in the same room with ethylene anesthesia.
3. As far as practicable, avoid the larger veins and arteries when using electro-coagulation.
4. Be cautious when operating around bony structures as there is always a risk of destroying the periosteum.
5. Start every operation with the thought that too much speed may be the cause of possible failure when the operation might have been successful if more time and care had been taken.

Monopolar Desiccation

The term "fulguration" was formerly applied to what we shall refer to as monopolar desiccation. This is a dehydrating process usually employed in the removal of lupus vulgaris, warts, moles, etc.,—superficial lesions. No indifferent electrode is used; application is made from the higher voltage high frequency current instead of bipolar diathermy outlets.

These applications may or may not be painful depending on the depth and area of the lesion under treatment, but it is generally advisable to employ a local anesthetic. Many operators find an indirect application better than this direct monopolar treatment.

The indirect method is obtained by placing a metallic electrode either on the chest or over the cervical spine, when working on the head, or somewhere near the site of operations when working elsewhere on the body, which pad is connected to the high voltage high frequency terminal, and pointed electrode, not insulated, is held in operator's hands.

The patient may hold a metal auto-condensation handle firmly in both hands to make connection to the proper outlet on the machine, but the resistance of the wrists and arms must be taken into consideration and more current employed than where the plate electrode was placed closer to the point of contact of the active electrode as first described.

Another indirect method, bipolar instead of monopolar, is obtained by connecting the auto-condensation pad or cushion to one of the D'Arsonval or diathermy outlets, and the active electrode to the opposite diathermy pole. The patient may either sit or recline on the pad or cushion, and the active electrode is held in an insulated holder in the operator's hands. Application to the growth or lesion is made exactly as described under the indirect method, but sparks will be shorter and much hotter and more caustic, because more milliamperage is obtained by this method; the pad offers less resistance to the current. This method may be used for actual coagulation procedure.

The needle or pointed electrode is held firmly in the operator's fingers and may either be placed in contact with the spot to be removed before the current is turned on, or the current turned on first and the needle then applied.

When employing the indirect method current goes from the patient to the needle in the operator's hands. The application is less painful than the direct method; the operator will feel no sensation of currents, no ill effects will result, but the penetration will be less than when employing the direct method. This is the method of choice in treating moles and naevi.

Auto-Condensation

The D'Arsonval auto-condensation treatment is

Sedative,
Reduces high blood pressure,
Increases metabolism and body heat, and is most useful in:
Neurasthenia,
Cardiac and gastric neuroses,
Arterio-sclerosis,
Toxic conditions,
Dysmenorrhea,
Leukemia,
Acidosis,
Menopause, and
Insomnia.

The bipolar current is employed.

The necessary appliances for administering this treatment consist of a folding chair pad or padded cushion, on which the patient either sits or reclines, and a metallic handle which is usually held in the patient's hands. The patient undergoing treatment really forms one section of a condenser.

The auto pad, as we will call it in the following, consists of a metallic plate covered with sufficient insulation to prevent the high voltage current jumping thru, and this plate forms the opposite side of the condenser.

When administering an auto-condensation treatment it is well to remember, as in the giving of any electrical treatment, to employ only a moderate amount of current at the start regardless of the amount of milliamperage that may follow, and then to taper off each treatment by cutting the current down gradually before opening the switch.

The volume of milliamperage will depend on the nature of the case, although 600 to 850 M. A. are about average. Most operators agree that the milliamperage used for the first treatment should not exceed 300, that this current be increased at subsequent sittings to the desired maximum, and to taper off gradually to the end of the series of treatments. As an example: it has been proven in high blood pressure cases by breaking the series of treatments off too abruptly the effect will be lost in a short time, that



Auto-condensation Handle.

the patient's blood pressure may have been reduced for the time being but that it soon rises again. On the other hand,

Auto-Condensation—Continued

tapering the milliamperage off gradually, the effect is more lasting and usually quite satisfactory.

Do not touch your patient during a treatment, as the shock at the point of contact will be disagreeable. Be sure that you use a wooden chair or wooden table. Never place the auto pad in contact with metal. You will find from experience that you will be able to pass a great deal more D'Arsonval current thru a stout patient than thru a thin one. This is just the opposite of the effect obtained in administering medical diathermy, as an obese person will take less milliamperage at a given setting of the controls on the machine than a thin one.

You should always recommend that your patient drink a great deal of water during a series of auto-condensation treatments. See that he drinks a glass of water immediately preceding each treatment. One of the most important features of an auto-condensation treatment is that your patient must be fully relaxed and made just as comfortable as possible.

Patients with exceedingly high blood pressure, and with a slow pulse, should be carefully watched during and after treatments.

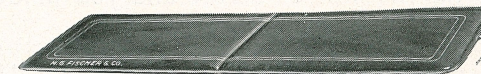
The treatment of hardened arteries, walls lined with calcareous deposits, must be undertaken in a systematic way if lasting results are to be obtained. To lower the blood pressure too suddenly in these conditions is very dangerous.

During the menses it is inadvisable to use any high frequency treatments, but on the contrary, in cases of suppression, auto-condensation may be used as a stimulant.

It is well to place the patient's hands on a pillow or large book when using a metal handle, in this way keeping the hands away from the body proper so there will be no danger of sparking. Caution your patient not to drop this metal handle with the current on, or even relax the hold, as resulting sparks will be sufficient to cause a severe burn.

Do not use auto-condensation in advanced arteriosclerosis or in extreme old age.

At Right:
Auto-condensation
Couch Pad.



At Left: Auto-con-
densation Couch Cush-
ion.

High Frequency

High frequency vacuum and non-vacuum electrode applications are not as widely used as in the past because the effect is only superficial as compared to the far deeper auto-condensation and diathermy treatments. However, high frequency electrode applications are quite clearly indicated in infectious skin diseases, as well as infections in the orifices which can be reached with the electrodes.

High Frequency currents:

Dilate the blood vessels	Increase lymph circulation
Increase local blood supply	Promote absorption of exudates
Increase oxidation	Liberate ozone
Increase elimination	

These applications are used in the treatment of:

Skin ulcers	Blepharitis
Local debilitated conditions	Lumbago
Localized edemas	Uterine disease
Painful localized conditions	Tonsillitis

When the glass vacuum electrode is properly connected to the high frequency terminal on your machine, that is, with the aid of the proper handle and conducting cord, and the switch closed, it does not always illuminate with the familiar violet colored glow.

If current does not immediately pass thru the electrode, grip the glass with the bare hand to warm it, or increase a bit the volume of current passing.

When an electrode becomes what we might term "stubborn" and will not light up, shut off the machine, leave the controls as they were but remove the heavy cord from the active pole and remove the electrode from the high frequency handle. Hold the electrode firmly in the bare hand. Start the machine and then touch the glass electrode itself to the active post, and unless the tube is punctured or otherwise defective, it will glow properly. Then shut off the current, connect the cord, handle and electrode to the machine as before and you should have no further trouble.

* * * * *

Metallic electrodes directly connected to the diathermy current are far more effective and will produce better results than the glass vacuum tubes.

Vacuum electrodes do not administer ultra-violet rays to the patient.

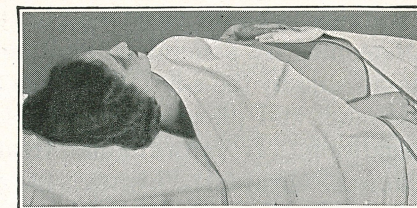
There is no such thing in physiotherapy as a "Violet Ray."

DIATHERMY THERAPY

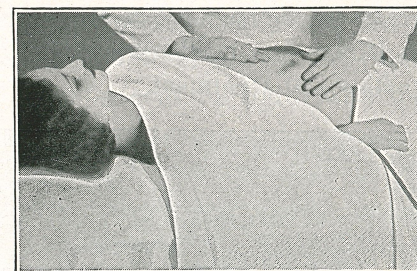
An Alphabetical List of Indications and Treatments

Adhesions

While diathermy cannot be expected to remove organized adhesions, especially fibrous bands usually encountered in the abdomen, or pleuritic adhesions of long standing, this agent will, in the majority of instances, relieve the pain and favorably influence muscular spasms (peristalsis). The treatments should be mild, an average of 600-1200 milliamperes being sufficient.



Application of Electrodes in Adhesions



Adhesions—Massage

Adenitis, Cervical

Indirect diathermy is the method of choice in Adenitis. The patient is placed on the auto-condensation pad, which is connected to the Tesla post of the machine, and treatment is given by the indirect method, the operator using his fingers for the other electrode. Diathermy should not be applied if suppuration is pent up. X-ray treatment and ultra-violet light are valuable aids.

Adenitis, Inguinal

See Buboes, p. 37

Albuminuria

Albuminuria being a general term, diathermy is applicable only when indicated by the cause or pathologic condition involved. In functional (cyclic) albuminuria, of course, diathermy has no direct indication. In the renal forms diathermy has a distinctive therapeutic value.

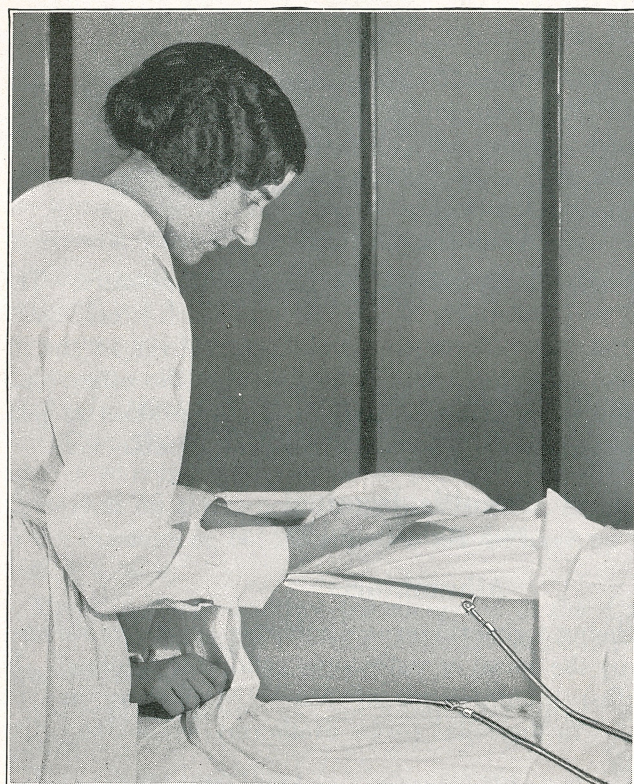
Amenorrhea

See Diathermy in Gynecology, pp. 55 to 58.

Diathermy to the female pelvis is indicated in this condition, preferably with the Chapman vaginal electrode. The following technic has been described in above article, but do not use excessive milliamperage. About 1500 milliamperes is sufficient. The treatments should be given about three times per week, and supplemented by general irradiations from the air-cooled ultraviolet lamp, and by the administration of a ferruginous tonic and arsenic. Calcium and phosphorus are also useful in the treatment of this condition. If intra-vaginal treatments are contra-indicated, because of unruptured hymen, etc., a mesh or block-tin electrode may be applied anteriorly above the pubis and posteriorly over the sacrum with satisfactory results.

Anemia, Secondary

Diathermy to the long bones is a useful adjuvant to other methods of treatment.



Left — Application of Electrodes in Anemia.

Analgesia

As a general proposition diathermy should not be used in any condition marked by an impairment of the sensory nerves. On account of the inability of the patient to experience pain, diathermy in conditions associated with analgesia is contra-indicated, as a severe burn might result.

Aneurysm

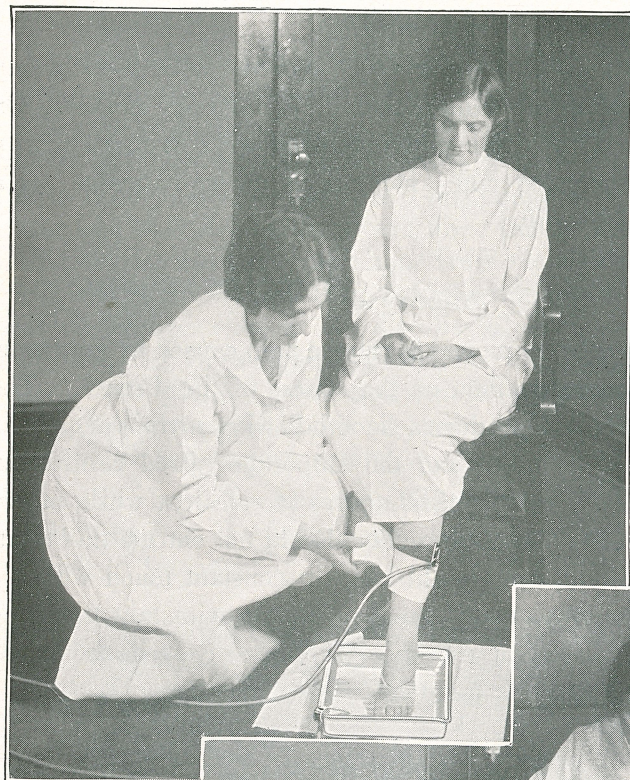
Diathermy may be employed to relieve pain caused by an aneurysm, but has no direct effect on the course of the disease. The lowest voltage that will produce a smooth-flowing current across the spark-gap should be used, and the amperage raised cautiously. Some men claim that 100 milliamperes is sufficient while others use as high as 1200. The physician should not entrust this treatment to an assistant, but should keep in constant touch with the patient during treatment. Electrodes of approximately the same diameter as the depth of the tissues to be traversed should be used. Treat ten to twenty minutes.

Angina Pectoris

Careful diet and abstinence from all undue exertion are important. During the paroxysms it is essential that the spasm and constriction be controlled. The medication generally favored is nitroglycerine in large doses. Diathermy directly to the affected region is excellent, and may be employed two or three times a week as a preventive, as well as in emergency. Use large block tin or mesh electrodes directly over the heart and on the back. Employ the minimum dosage that will give relief, 400 to 1000 M. A., for 10 to 12 minutes.

Angioneurotic Edema

Medical diathermy has proved valuable in the treatment of this condition. The treatments should be given daily and the amperage elevated to skin tolerance. Treat for from twenty to thirty minutes, using large block tin or mesh electrodes.



Ankle, Diathermy to

At Left: Cuff electrode above ankle, foot immersed in basin containing $\frac{1}{2}$ in. of water in which other electrode is inserted. Elastic bandage being applied.

Indications: All painful or inflammatory conditions of foot and ankle.



Ankle, Diathermy to

At Right: Treatment of ankle by diathermy, using two mesh sponge electrodes, one on either side of ankle, held in place by elastic bandage. 700 to 1000 milliamperes for 20 to 30 minutes.

Ankylosis, Fibrous

Apply diathermy by means of half-cuffs above and below the joint, or through the joint, by means of sponge, mesh and clamp, followed by massage.

Arterio-Sclerosis

Diathermy, combined with the general treatment, may be used to advantage, especially in the early stages. The patient is given autocondensation treatments of 20 to 30 minutes duration, daily, lying on the autocondensation pad and holding the autocondensation handle. The current is advanced very gradually to 300 milliamperes; do not exceed this until you are sure the patient will react favorably to more. Under favorable conditions as much as 700 milliamperes may be given. At the conclusion of treatment, the current is shut off very slowly. Contraindications are hypotension, low systolic and high diastolic pressure. Be cautious about lowering the blood pressure too rapidly in these cases.

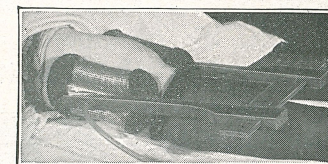
Arthritis

Unquestionably the most important feature of the diagnosis and treatment of any case of arthritis is the discovery and the removal of the underlying causes.

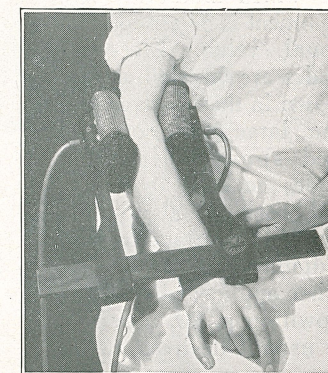
The acute stage frequently follows exposure to cold and dampness, and these conditions are sometimes erroneously accepted by the patient as the cause of the disease. As a matter of fact, they have merely served to bring the trouble to a focus.

After the cause is removed, diathermy treatment may be instituted in all cases, and is generally accepted as the most satisfactory method of curing the acute disease and arresting it in the chronic stages.

With diathermy we can produce an active hyperemia in the diseased joint, one of nature's methods of overcoming a pathological condition, reducing congestion and absorbing exudates.

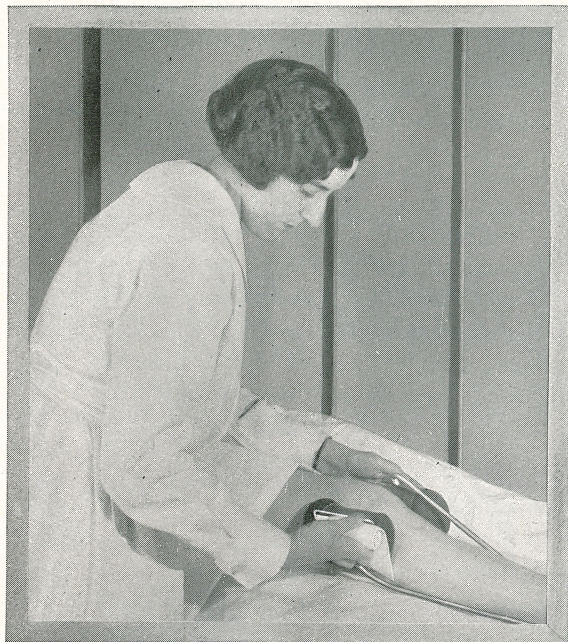


Arthritis of knee treated by means of diathermy clamp.



Arthritis of elbow treated by means of diathermy clamp.

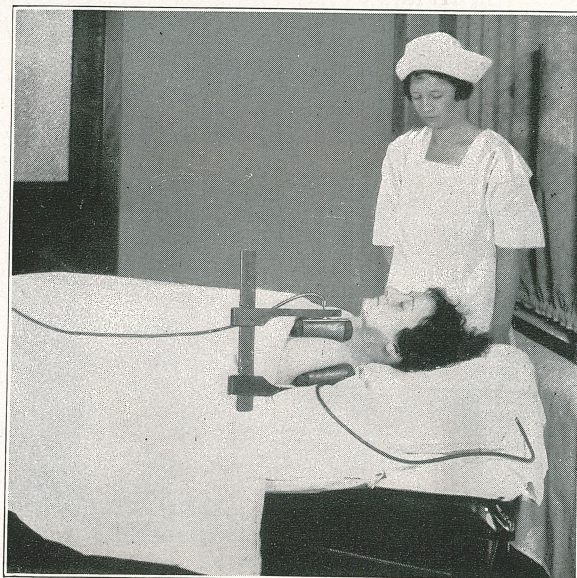
Arthritis of Knee Joint



At Left—Application of sponge electrodes to knee joint. These are held in place by loose bandage, preferably elastic, or by diathermy clamp sponge electrodes to knee (see pp. 64, 65.)

Arthritis of Shoulder

This is a condition for which diathermy treatment is of exceptional value. Electrodes are applied as shown in the illustration, large mesh covered sponge electrodes on both front and back of shoulder, held in place by a diathermy clamp. Other applications as shown on p. 80, may be used if desired.



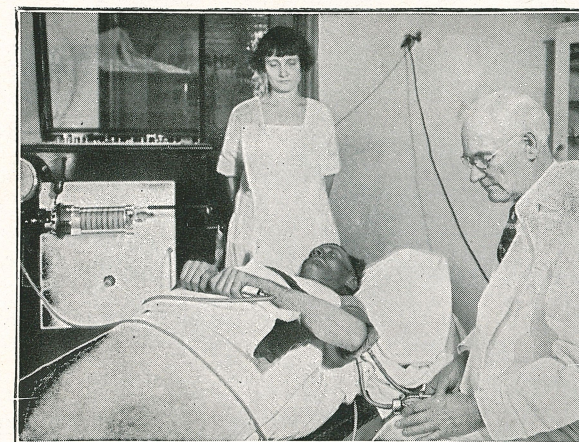
Atony

Medical diathermy is indicated in the treatment of impoverished tissues, however, if there is an impairment of the sensory nerves, great care should be exercised to prevent burning. The main value of diathermy lies in its effect on the vascular system. Freshly oxygenated blood is drawn to the part and the metabolic exchange proceeds more rapidly. Treat thirty to sixty minutes daily, using just sufficient current to produce a pleasant sense of warmth within the tissues. Apply electrodes as in Arthritis, (pp. 31, 32).

Auto-Condensation

For auto-condensation treatment for hypertension, the patient lies supine on the auto-condensation pad, which pad is connected to one terminal on the diathermy machine, and grasps the large metal handle which is attached to the other diathermy terminal. The patient's position is illustrated below. Remove any of the patient's clothing that may contain metal fastenings. During treatment, the patient's hands should be supported on a small pillow, to prevent sparking.

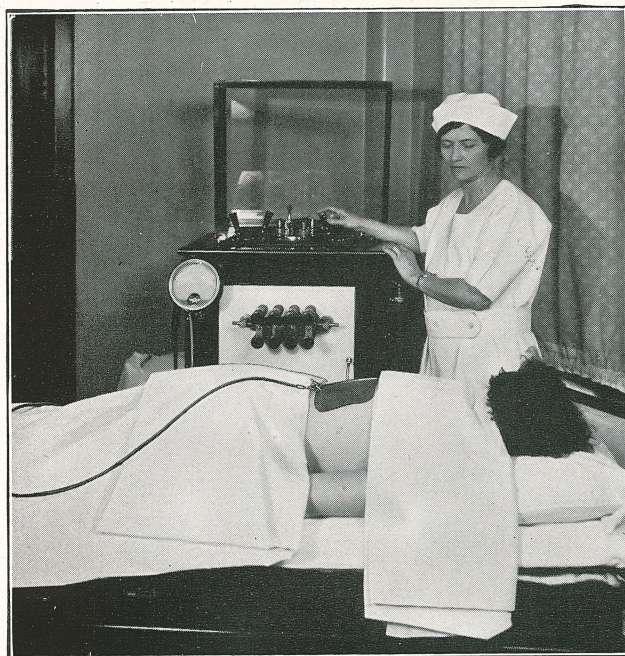
Below—Auto-condensation for high blood pressure. Pressure is being taken at intervals as treatment progresses. Bipolar current, 600 milliamperes for 20 minutes. Treat daily. In the presence of heart and kidney complications the auto-condensation treatments are often not borne well by the patient. The physician should keep in constant touch with his patient during the treatment, and not leave these cases to the care of an inexperienced technician.



Auto-Condensation—Continued

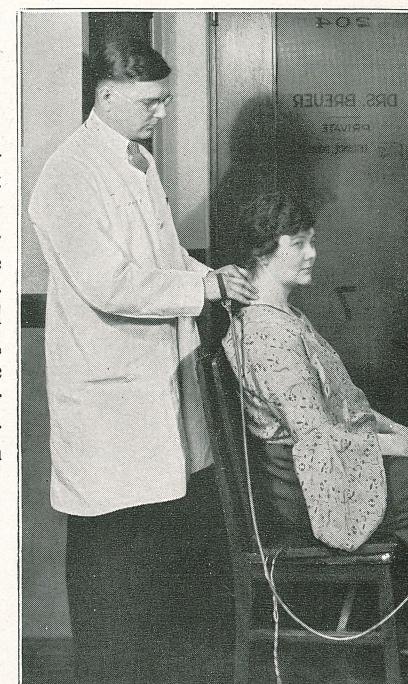


At Left — Recently reports are had of physicians obtaining satisfactory results by substituting a 7 in. by 9 in. metal electrode over the chest for the hand electrode. 300 to 700 milliamperes for 20 minutes.



At Left: In hypertension associated with chronic interstitial nephritis, beneficial effects may be obtained by placing the patient prone on the auto-condensation pad, and a 5 in. x 7 in. metal electrode held in place by sand bags, over the kidneys. 500 to 750 milliamperes for 20 to 30 minutes.

Auto-Condensation—Continued



At Right — Pleasant auto-condensation treatment for the neck. Patient seated on pad, other pole of bipolar current passing through operator's fingers to neck.

Back, Diathermy to

This treatment is of great value in spasticity and rigidity of the muscles of the back, or in fact for spasticity or rigidity of any muscles. Not only will these abnormal conditions be overcome by the application of diathermy, but the pain and tenderness attendant upon these conditions will soon be remedied.

It is good practice to apply mild surging sinusoidal treatment or hand massage to the affected muscles after the application of diathermy. It will be noticed that the tenderness on pressure that the patient complains of before the treatment, is practically eliminated after the first treatment. If there is any return of the tenderness in the forty-eight hours following the treatment, it will be nothing in comparison to what existed before.

Back, Diathermy to—Continued



The illustration shows how two large mesh electrodes are placed over the abdomen and under the back, with the larger one on the abdomen.

Bipolar current to patient's tolerance for 20 minutes.

Bronchitis, Acute

See Pneumonia, pp. 77 to 79—technic is same.

Bronchitis, Chronic

Make sure that the condition is not one of incipient tuberculosis. Diathermy treatments should be given through the region of the affected bronchi. Treatments should be mild, long, frequent, and continued. Also treat the patient's general condition by diet, rest and tonics.

Buboes

Diathermy may be used to good advantage in an effort at aborting the progress of the inflammation. Failing in this it may still further be employed to hasten resolution by bringing an oversupply of blood to the inflamed glands. Treatment should be discontinued at the first sign of softening or suppuration, and the pus evacuated. Radiant and ultra-violet light should be used for subsequent treatments.

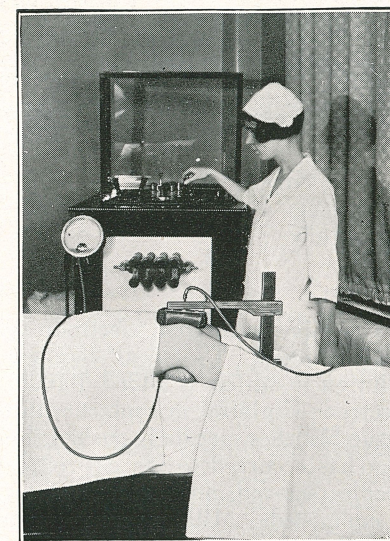
Dose of diathermy is moderate tolerance for the patient for thirty minutes daily. The active electrode should be applied directly over the inflamed gland and should be slightly larger than the area to be treated. The indifferent electrode should be large and should be placed as nearly opposite the active electrode as possible.

Bursitis

Diathermy applied daily thirty to forty-five minutes, followed by gentle massage and manipulation, furnishes a form of treatment from which one may confidently expect prompt relief from the pain and normal restoration of function within 2 to 3 weeks.

If only a moderate amount of fluid is present, absorption quite readily takes place. If absorption does not occur it should be aspirated under strictly aseptic conditions.

Following treatment, as in a knee or elbow, the part should be snugly bandaged with an elastic bandage.



Showing use of diathermy clamp in applying mesh covered sponge electrodes to knee.

Cancer

It is held by most physicians and surgeons that cancer is curable in most cases when discovered before metastasis has occurred. The danger of metastasis is much less when Diathermy is used than in operations with the knife, since diathermy seals the blood vessels and lymphatics, thereby lessening the chance of spreading the malignancy at the time of operation.

Surgical diathermy is the method of choice of a very large number of surgeons in the treatment of cancerous growths. Among its advantages are accuracy of control, immediate relief of pain, thorough and immediate sterilization of the wound, absence of shock, practically no hemorrhage, little danger of secondary hemorrhage, much less danger of extension and metastases than in use of the knife. Small lesions are removed quickly and painlessly by this method; in large operable lesions it has all the advantages mentioned above; inoperable cases, so-called, surgical diathermy permits the surgeon to operate in otherwise inaccessible locations, and in cases of extensive vascularity and involvement where the sealing of lymphatics and blood vessels is essential.

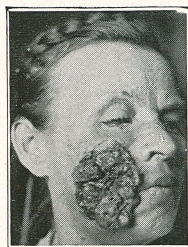


Fig. A

Cauliflower Epithelioma

Successfully removed by surgical diathermy. Illustration A shows side view of the growth; B, same patient after operation showing wound healed.



Fig. B

Treatment of Epithelioma

The large indifferent electrode is attached firmly to the back, between the shoulders. Use local anesthetic, one-half of 1 per cent novocaine solution to which is added 1-1000 adrenalin solution. Active (needle) electrode is placed in contact with the tissues and current turned on. As tissue blanches, needle is pushed slowly forward in the tissue until destruction has occurred to the desired depth. Current is then turned off, the needle removed, and adjacent areas similarly treated until the operation is completed. Milliampères, 700 to 2500, to be gauged by size of the lesion, tissue resistance and current delivered by the individual machine. Indications, all epitheliomata. Contraindications, none. After-treatment, sterile dressings, X-ray or radium therapy, actino-therapy.

Cancer—Continued

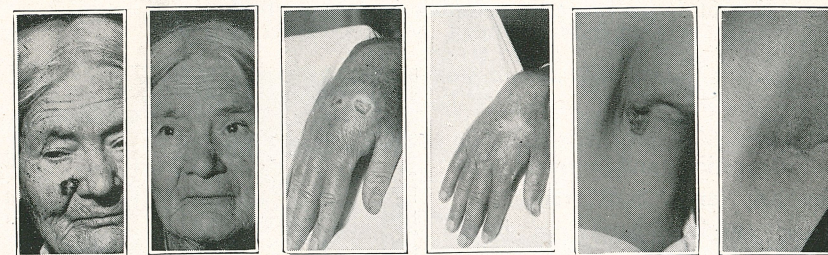


Skin Cancer

The above illustration on the left shows a small skin cancer treated by "cancer paste," resulting in severe skin necrosis and rapid spreading of the process. The right illustration shows the same patient completely healed following treatment by surgical diathermy.

Treatment

Surgical diathermy used to remove malignant tissue, technique as described on page 38. Also X-ray, skin cancer dosage, and actino-therapy, 3 to 10 minutes daily.



A B C D E F

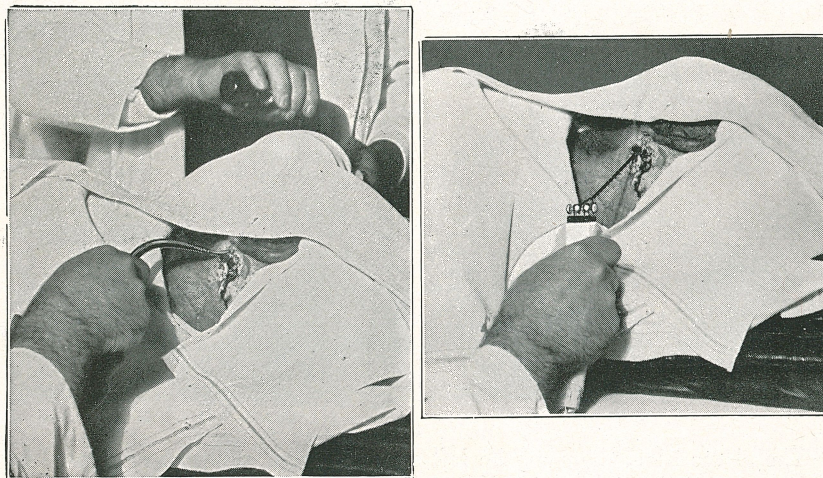
Epitheliomata

Illustration A, epithelioma near ala of nose; B, after treatment by surgical diathermy. C, epithelioma of dorsum of hand; D, after treatment by surgical diathermy. E, epithelioma in axillary region; F, after treatment by surgical diathermy.

Treatment

Electro-coagulation by diathermy current, large indifferent electrode attached firmly to back, suitable needle electrode for active electrode. Local anesthetic, one-half of 1 per cent novocaine solution, to which is added 1-1000 adrenalin solution. Milliampères, 700 to 1500 or more, depending on size of lesion, tissue resistance and machine used. Technique as on page 16. Indications, all epitheliomata. Contra-indications, none. After-treatment, sterile dressings, X-ray or radium therapy, actino-therapy.

Cancer—Continued

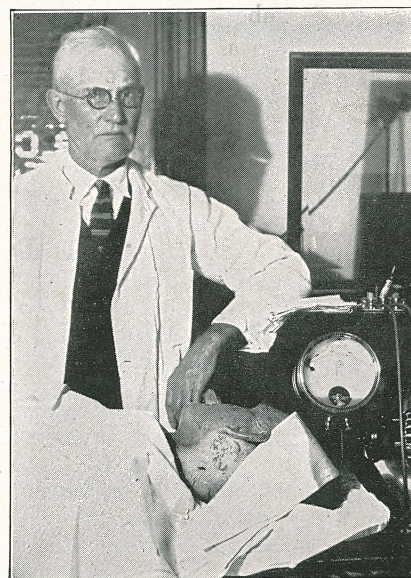


Carcinoma

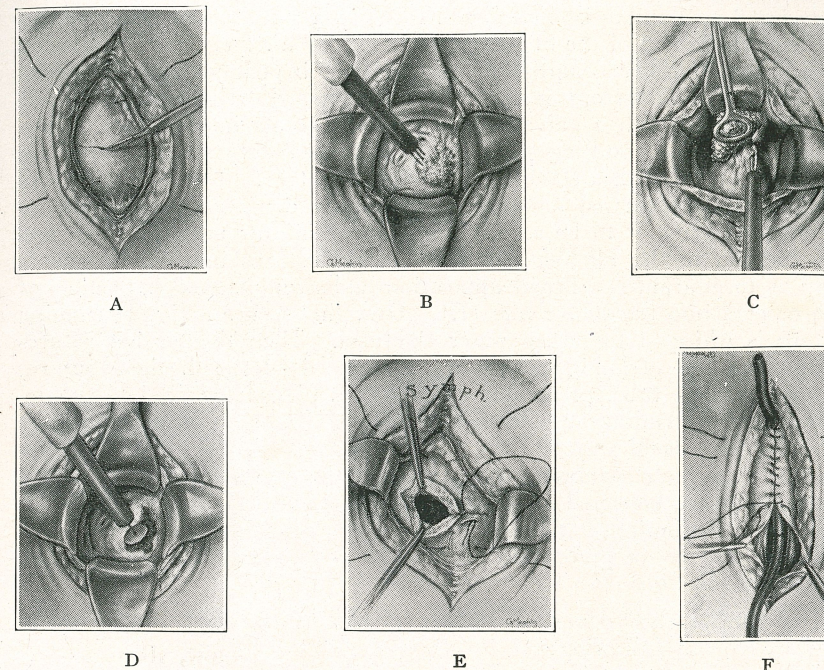
Above, at left, destroying cancerous tissue by surgical diathermy, under chloroform anesthetic. Above, at right, fulguration of cancer (using electro-cautery). Below, illustration of large cancer developing in left mastoid region.

Treatment

Fulguration and surgical diathermy, large indifferent electrode attached firmly to back, suitable small active electrode from Fischer Electrode Set. Anesthetic, chloroform. Milliamperes, 700 to 2500, depending on size of lesion, resistance of tissues and machine used. Post-operative treatment, X-ray and sterile dressings. Duration of post-operative treatment, indefinite. Indications, all accessible malignant growths. Contra-indications, none.



Cancer—Continued



Surgical Diathermy in Bladder Malignancy

The above six illustrations show the various steps in this operation as performed by Gustav Kolischer, M. D., Michael Reese Hospital, Chicago. Detail of Dr. Kolischer's technique given below.

Treatment

Inert electrode, block tin, 20x10 cm., fastened under hips. Barnes bag inserted into rectum and distended by 200 c. c. of water, raising trigone and facilitating clearance of vesical base. Usual median abdominal incision exposing anterior aspect of bladder; reduplication of peritoneum stripped off by gauze dissection, exposing freely the outer anterior bladder wall. Then in the upper and lower angles of the wound two tension sutures are inserted which penetrate the bladder wall. The ends of the sutures are secured by metal clamps, whose weight helps to elevate the bladder, which in later stages makes the vesical cavity better accessible. Now the bladder is opened between these guy ropes by a transverse incision (illustration A). The transverse incision, while permitting free exposure of the vesical interior, offers the advantage of facilitating the suture of the bladder wound and at the same time prevents oozing of urine into the cavum retzii, in case the suture line should give. Then in the upper and lower angle of the vesical incision a fiber retractor

Cancer—Continued

is inserted. If one encounters an arboraceous bushy tumor, an electrode carrying 3 or 4 spikes is chosen, and by raining a shower of heavy sparks all over the crown of the tumor (illustration B) a superficial coagulation or carbonization is accomplished. If the tumor is pedunculated, its seared top is seized with forceps and gently pulled upward. The exposed pedicle is now severed with a galvanocautery closely to its implantation (illustration C). The resulting stump and the immediately adjacent area are now coagulated with a stamp-shaped electrode (D). The sideration and coagulation are carried on until a thoroughly dry scab results and no punctuate oozing is to be seen. The bladder is now mopped clean and the incision in the bladder closed by catgut sutures inserted in such a way as to guarantee a broad apposition and avoidance of impaction of the mucosa into the suture line (E). Over this suture a simple running suture is whipped to insure water tightness. Then the tension sutures supporting the abdominal wall are placed. Underneath these sutures a fine drainage tube, preferably of silver, is placed, parallel to the incision and protruding at each end of it (F). Then fascia and cutis are closed in the usual way and the guy ropes are tied. The patient either begins to urinate naturally shortly after the operation or if unable to do so is catheterized at regular intervals until natural function is resumed. Beginning at the end of the first week after the operation as a matter of extreme precaution the bladder is regularly irrigated with an antiseptic solution.

For further discussions of various phases of Surgical Diathermy in cancer, see the following:

Milligan, W.:—Diathermy in Inoperable Pharyngeal and Epilaryngeal Malignancy. *J. Laryngology and Otology* 36:369, Aug., 1921.

Cumberbatch, E. P.:—Discussion on Surgical Diathermy.

Steward, F. J.:—Diathermy in Treatment of Malignant Disease. *Practitioner* 108:328, May, 1922.

Kolischer, G.:—Principles of Surgical Diathermy. Educational Series, H. G. Fischer & Co.

Kolischer, G.:—Surgical Diathermy and Radio-therapy in Cancer of Uterus. *Surg. Gynec. Obstet.* 35:227, Aug., 1922.

Patterson, N.:—Diathermy for Malignant Disease of Mouth, Pharynx and Nose With Notes on 17 Cases. *British Med. Journal* 2:56, July 14, 1923.

Wyeth, G. A.:—Endothermy in the Treatment of Accessible Neoplastic Disease. *Annals of Surgery*, 79:9, Jan., 1924.

Wyeth, G. A.:—Surgical Endothermy in Accessible Malignancy. *New York M. J.* 114:685, Dec. 21, 1921.

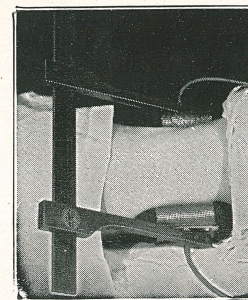
Wyeth, G. A.:—Endothermy in Treatment of Accessible Malignancy. *New York M. J.* 115:437, April 19, 1922. Illus.

Catarrh, Nasal

Diathermy is a valuable aid in the treatment of this condition. For technic see Diathermy to Nose, pp. 70, 71. Treat five to fifteen minutes using a non-vacuum electrode with sufficient current to produce a sense of warmth to the inflamed mucous membrane.

Cellulitis

Diathermy is of value in this condition because it relieves pain, combats the infective agent, stimulates phagocytic activity, and hastens resolution. Preliminary to the treatment of cellulitis with diathermy one must make sure that suppuration has not taken place. If pus is present surgical drainage must be performed following which diathermy is of distinct value. If the case is seen during the early inflammatory stage, most cases will respond readily to diathermy. This may be applied by means of the diathermy clamp and mesh sponge electrodes or perhaps better still, the block tin electrode, if the surfaces are such that they



Application of Electrodes with Diathermy Clamp

may be applied.

The dose should be fairly low milliamperage continued for a long period.

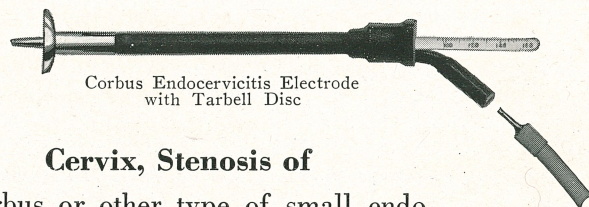
About 750 M. A. to each 15 sq. in. of electrode surface for 45 min. to an hour, once or twice daily till inflammation subsides. Careful watch should be kept for signs of suppuration and should this occur free drainage should be instituted before continuing the diathermy treatments.

Cerebral Hyperemia

Place large block-tin or mesh electrode over abdomen and have the patient lie on the autocondensation pad. Treat for twenty or thirty minutes at 600 milliamperes. This stimulates the vaso-dilator fibres and produces a congestion in the splanchnic area, automatically depleting the cerebrum. This treatment is very effective.

Cervicitis, Uteri

See section on Diathermy in Gynecology, pp. 55 to 58.



Cervix, Stenosis of

Use special Corbus or other type of small endocervicitis electrode. Elevate temperature until sufficient tissue destruction is produced to ensure a normal sized cervical opening. After the process has healed, sounds should be used occasionally in order to prevent cicatricial formation and a recurrence of the stenosis.

Chancroid

Chancroid is best treated by desiccation. The sore should be carefully cleansed, a local anesthetic applied, and time allowed for the parts to become thoroughly anesthetized. Apply direct spark until all of the Chancroid has been thoroughly charred. The after-treatment consists in absolute cleanliness of the part, though patients are grateful where soothing ointments are applied.

Cholecystitis

Diathermy, while of value in the treatment of an inflammation of the gall-bladder as in other inflammatory conditions, compels the physician to bear in mind the danger of rapidly breaking-down a purulent gall-bladder and producing a general peritonitis in a portion of the abdomen where as a rule it is rapidly fatal. Technic, same as in Gallstones, pp. 30 and 31. Treatment of gall-bladder disease by physiotherapy as well as medication, requires time and patience; results appear, not in a week, but in several months.

Coccygodynia

If this is produced by an injury to the bone or inflammation, diathermy will prove useful in its treatment. Patients in whom no pathological condition is apparent and the pain is only a symptom of a neurotic affection, may be benefited from a psychological effect. Apply one electrode over painful area and another—much larger—electrode over the lower abdomen. Treat twenty minutes at 1500 milliamperes.

Colic, Gallstone

See pp. 51 and 52.

Conjunctivitis

Vacuum or non-vacuum eye electrodes may be used, but a special metal electrode as used with the diathermy headband serves best. Treat five to ten minutes using low milliamperage. For application of electrodes see page 46.

Coryza

See Diathermy to the Nose, pp. 70, 71.

Cystitis, Acute

Place mesh electrode over lower abdomen, with larger indifferent electrode underneath sacrum. Raise milliamperage to patient's skin tolerance and treat thirty minutes to one hour daily. Some advantage is gained by having the bladder distended during treatment. The patient voids immediately after the treatment, thereby washing out the inflamed bladder.

Cystitis, Chronic

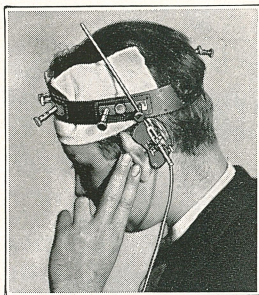
The treatment of chronic cystitis does not differ from that of the acute, except that the treatments need not be so prolonged and may be given only three times weekly. It is often necessary to wash out the bladder after treatment with a warm boric acid solution as many of these patients have retention of urine.

Duodenal Ulcer

Diathermy is used in duodenal ulcer to relieve the pain, and to promote healing. Treat thirty minutes daily elevating the milliamperage to the patient's skin tolerance. If the patient experiences vertigo or malaise during or after treatment, (over stimulation of the solar plexus with splanchnic congestion), lower the amperage. Apply standard (5x6 in.) mesh electrodes over the source of the pain and underneath the shoulders or spine. Quartz light treatment is a valuable adjunct.

Earache

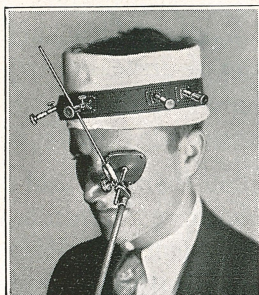
For intractable otalgia, diathermy should be used over the mastoid region for 30 minutes, followed by negative galvanism for 5 minutes. Repeat in 12 to 24 hours as indicated. Make sure that there isn't pus under pressure behind the tympanum.



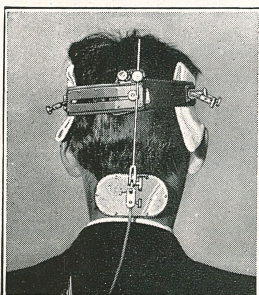
Application of active electrode to ear by means of head band.



Application of indifferent electrode.



Application of active electrode to eye by means of head band.



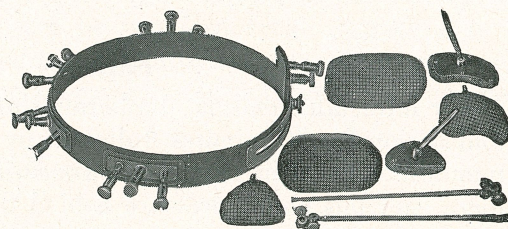
Application of indifferent Electrode

Ear, Diathermy to

Diathermy introduced by way of the ear canals does not reach the middle and inner ears with adequate intensity. The active electrode is placed in contact with the mastoid area of the ear being treated, while the indifferent electrode is placed on the opposite side, anterior to the ear. One ear is treated at a time. The point of greatest heat with the above technic is at the petrous portion of the temporal bone. Three to four treatments weekly are given with a milliamperage of 250 to 400. The time of each treatment is 20 minutes, after which negative galvanism is applied for 5 minutes. The number of treatments is determined only by the requirements of each individual case. This method is now being extensively employed for all types of otitis media.

Eye, Diathermy to

Diathermy to the eye is best applied directly by means of a metal electrode. The most convenient method is to apply the head band and special eye piece. Various eye affections are now being treated in this way.



Showing head band and special electrodes for use in diathermy treatment of eye and ear

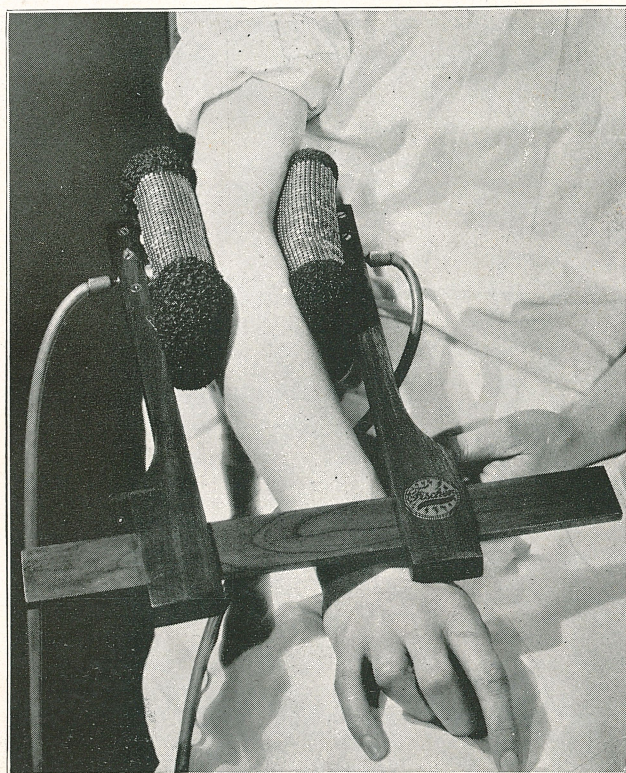
Electrode Non-Vacuum

At Left: Use of non-vacuum electrode, with monopolar current, in treatment of facial and glandular conditions. $\frac{1}{8}$ to $\frac{1}{4}$ in. spark, treatment for 10 to 15 minutes.



At Right: To avoid unpleasant sparking when making contact, connect tube to unipolar outlet of machine, regulate spark, then place your fingers on electrode until it is in contact with patient. (See illustration in oval.) Fingers are then removed and electrode is moved over area to be treated.





Showing mesh covered sponge electrodes held in place by diathermy clamp.

Elbow, Diathermy to

Application of mesh covered sponge electrodes by means of Diathermy Clamp. A satisfactory and effective method. Milliampères, 800 to 1200, patient's tolerance.

Endometritis

See section on Diathermy in Gynecology, pp. 55 to 58.

Epididymitis

Apply Corbus epididymitis electrode and treat daily or twice daily—twenty minute periods—until condition is relieved.

Fissure in Ano

Dilate the sphincter under an anesthetic. Treat by direct fulguration or use cautery. Dress with oily antiseptic dressing. Healing is usually complete in one week.

Fistula in Ano

If the fistulous tract is long and tortuous surgery is the only recourse. If it is possible to insert an aluminum probe throughout the length of the tract, this can be used as the active electrode, and the walls of the tract electrocoagulated. If the coagulation takes in all of the diseased tissue, healing by granulation will take place. Keep the tract drained by irrigation. If the coagulation was not thorough enough the first time, the procedure can be repeated in ten days or two weeks.

Fractures (After-Treatment)

After the fracture has been properly reduced, diathermy is of exceptional benefit. Internal heat reduces the edema and pain, minimizes the danger of ankylosis, and hastens bony union.

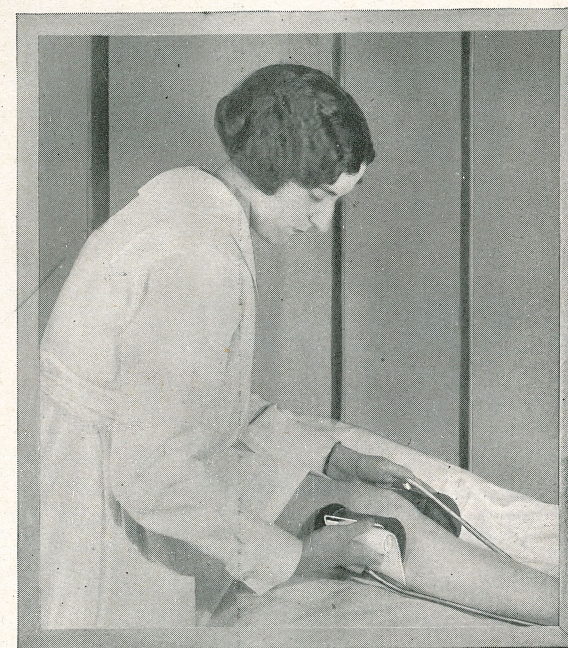
If it can be arranged, a diathermy treatment should be applied to the fracture before the immobilization dressing is put on. This will contribute largely toward preventing swelling and eliminating pain; it will promote callus formation.

Do not enclose electrode plates in a cast with a view to applying diathermy to the limb within the cast. The increase in size produced by diathermy will cause a pressure ischemia which may result in a loss of the limb. If it is possible, remove the cast or immobilizing dressing daily and apply the diathermy treatment. If this is not possible, windows may be left, through which the treatment may be applied. Otherwise, allow sufficient time for a callus to form that is strong enough to hold the ends of the bone in position, which is ten days to two weeks; and then begin applying diathermy, continuing the immobilization.

Diathermy is also useful in building up the nutrition of muscles that have remained in a cast for many weeks; to this should be added massage, and stimulation by sharp sparks from the glass-vacuum electrode.

Proper use of the electrical modalities in fracture of the elbow will avoid the permanent disabilities which sometimes follow injuries of this nature.

Various methods of treatment, with technic, are given on the following pages.



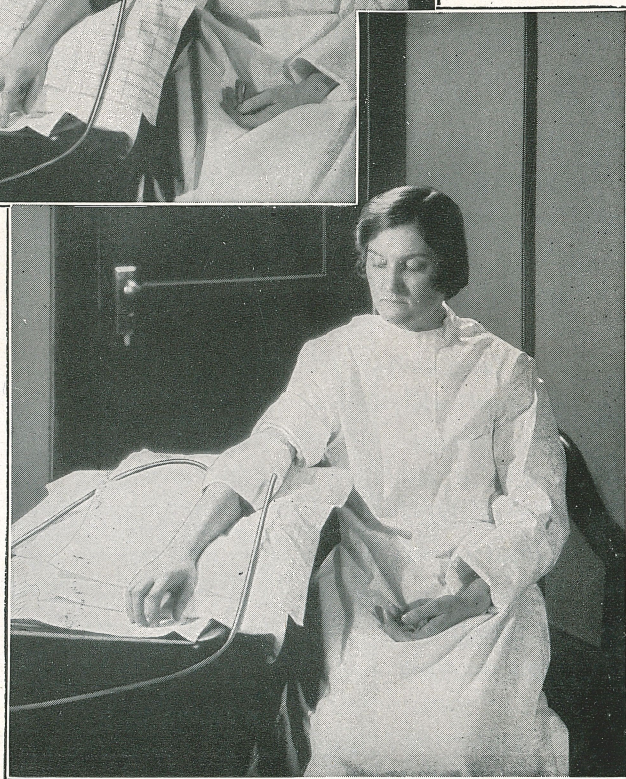
Showing sponge electrodes being applied to fractured knee



Fractured Elbow

Applying Electrodes

At Left—
Mesh sponge
electrodes ap-
plied lateral-
ly.



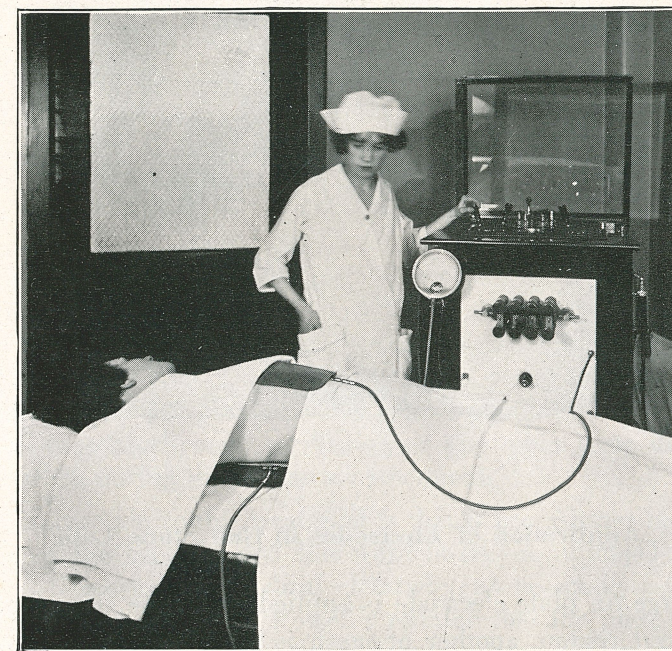
At Right—
Method of
bandaging
electrodes in
place with
elastic band-
age.

Gall Stone Colic

We assume that by gall stone colic is meant the pain produced by the passage of biliary calculi through the cystic, hepatic or common bile ducts.

When the stone starts down the duct, the irritation produced immediately sets up a spasm which persists until the smooth muscle fibers of the duct are tired to the point of relaxation. The acute pain then somewhat subsides, only to recur on subsequent irritation. This accounts for the paroxysmal character of the pain of gall stone colic.

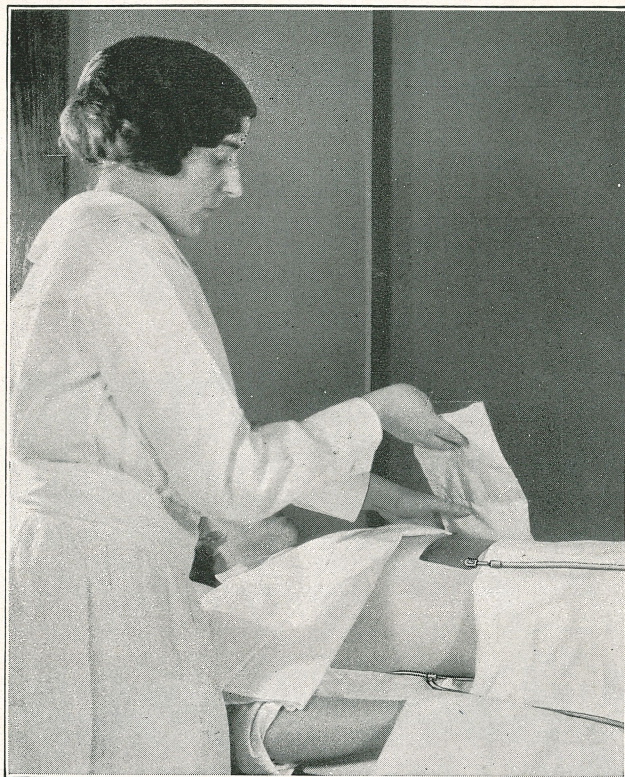
Diathermy is of distinct value and should be employed during an attack of gall stone colic, as it favors a relaxation of the duct and permits the stone to pass into the duodenum.



Diathermy Treatment of Gall Stone Colic.

Gall Stone Colic—Continued

Use 5 x 7 in. electrode posteriorly and 4 x 5 in. anteriorly, the latter placed just over the gall-bladder and the former opposite it.



Application of Electrodes in Gall Stone Colic

A large tin plate electrode is applied under the seat of pain in the dorsal region, another of mesh is placed anteriorly so as to include the painful area. It is held in place by sand bag.

Gangrene

In the predisposing stages, before tissue death has taken place, especially in the cases of endarteritis obliterans, a great deal can be accomplished by diathermy toward preventing the supervention of gangrene.

Gonorrhea

Heat is a specific for all gonococcal infections; the only problem that confronts the physician is the effective application of diathermy to the infected area. This problem has been solved in the female; refer to the section on Diathermy in Gynecology, pp. 55 to 58. In the male, however, this problem assumes greater proportions. No procedure that will apply in all cases has been perfected as yet, but the following methods have met with more or less success in the hands of their originators.

Rowell uses an electrode consisting of two parts—a bakelite frame with two adjustable pieces of metal, curved to fit the outside of the penis, and a straight, nickel-plated, perforated electrode to be inserted into the urethra. The latter is attached to one pole of the diathermy current and the external electrodes are connected to the other pole by means of a multiple connector and a double cord. A special thermometer in the urethral electrode makes it possible to keep a constant check on the temperature.

The thermal death point of the gonococcus is given as 104° F. for a period of 6 to 8 hours, or 108° F. for 30 to 40 minutes. It is therefore reasonably safe to assume that a temperature of 109° F. to 110° F. will destroy the organism in living tissue in 30 or 40 minutes, and this degree of heat can be very easily obtained without any discomfort to the patient. In fact it is possible to apply a uniform heat of 112° F. to 114° F. degrees to the male urethra from the cut-off muscle to the meatus. Rowell has had better results, however, with a temperature of 109° for 30 minutes than with the higher temperatures. It is also possible to apply a solution of mercurochrome, acriflavine or any other drug desired to the urethra during the diathermy treatment.

One objection to this treatment is that it necessitates instrumentation of the urethra, and therefore is contra-indicated in acute cases. However, the urethral electrode can be made as small as No. 16 French, and it is Rowell's opinion that the good obtained by the treatment will more than offset any harm that may be done by the insertion of so small an instrument.

Gonorrhea—Continued

Roucayrol uses a special urethral electrode which is inserted inside the penis with an indifferent electrode over the abdomen. This special electrode carries a thermometer and Roucayrol treats for twenty minutes daily with the thermometer registering 45 degrees Centigrade. He claims excellent results.

Corbus & O'Connor also use the special endo-urethral electrode and recommend temperatures of 108 degrees Fahr., and even higher for thirty minutes. The indifferent electrode is placed over the abdomen or sacrum.

For the active electrode Chapman uses silver mesh, cut in such a way that it can be wrapped around the anterior third of the penis. Antiseptic soap is applied freely to insure a good contact during the treatment. To prevent short-circuiting the current through some other part of the body (the thigh if the patient is treated in a sitting position, or the abdomen if he is lying down) the penis is placed in a small saucer, either on the legs or abdomen. A large piece of block tin on the patient's back serves as the indifferent electrode. Treatments are given for 60 minutes daily at the patient's point of tolerance.

Another method that has met with some success is to suspend the penis in a small jar containing salt solution which acts as the active electrode. In this treatment care must be exercised to prevent burns as the glans penis is almost devoid of heat fibres and unless a considerable portion of the penis is immersed in the solution, scalding may result.

The Cumberbatch method of applying the diathermy follows: A ribbon of lint, 1 inch wide, soaked in saline, is wrapped around the free end of the penis, and around the lint is placed a metal band. This is connected to the diathermy machine. An indifferent electrode is placed above the pubes. The current is gradually increased, and the penis is kept as hot as can be borne without discomfort, for 10 minutes.

In treating gonococcal urethritis, the indifferent electrode might be replaced by a second active electrode placed on the perineum. The prostate and the prostatic part of the urethra might be treated by a slightly concave metal electrode, shaped like a shallow spoon, mounted on an insulated handle, and placed in the rectum and pressed against the prostate.

Gynecology, Diathermy in

Diathermy, when used in the treatment of inflammatory diseases of the female pelvis has the following general effects:

1. It alleviates pain. 2. It has a localized action. 3. It increases the blood-supply to the part. 4. It leaves no bad after effects. 5. Bacteria are either killed or attenuated in virulence according to their ability to resist high temperatures. The gonococcus is attenuated in virulence and prevented from reproduction by a temperature of approximately 104 degrees Fahrenheit.

On account of its analgesic action, diathermy is indicated in painful menstruation. On account of its vaso-motor effects, it is indicated in amenorrhoea. Its greatest value, however, lies in the treatment of inflammations in which it has a specific action upon the infective agent as well as in producing the general beneficial effects already mentioned. The technic in all of these conditions is approximately the same. Any variation from the routine treatment is given underneath specific title of disease.

From what has already been said, it is apparent that, in the treatment of gynecological conditions by diathermy, we are more concerned with the location of the disease than with its specific cause. We are aware, however that pathogenic bacteria behave differently when exposed to heat, and I will mention the resisting power in vitro of a number of the microorganisms that are found most frequently in pelvic infections.

Streptococci—110-125 degrees F., in from 10 to 20 minutes.

Staphylococci—140 degrees F., in approx. 30 minutes.

Tubercle bacilli—140 degrees F., in approx. 20 minutes.

Gonococci—140 degrees F., in approx. 30 minutes.

You will note that the thermic resistance of the gonococcus in vitro is as high as that of any of the other pathogenic microorganisms. This is significant as it has been found that in vivo the gonococcus is prevented from reproduction by temperatures in excess of 104 degrees F., and Corbus & O'Connor claim that 108 degrees F., destroys the micro-organism in 30 minutes. Ehrlich states that the time is much less, but the importance of these factors is merely to determine the duration of the treatment, and it would appear that where it is possible to elevate the temperature of the tissues to 108 degrees F., 30 minutes time is sufficient to destroy all common types of pathogenic bacteria.

Gynecology, Diathermy in—Continued The Chapman Vaginal Electrode

This instrument is furnished in two sizes, and comes either with or without the thermometer attachment. For accurate work, however, the thermometer is absolutely essential.

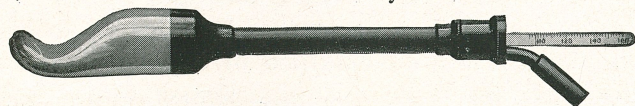


Fig. 1. Chapman Vaginal Electrode with Thermometer.

Application of Electrodes

In the treatment of buboes, perineal abscesses, ulcers, vulvitis, anterior vaginitis, anterior urethritis, etc., a mesh sponge applied directly to the infected area with a larger indifferent electrode over the abdomen or the sacrum is indicated. In the treatment of disease of the internal female organs, however, the special Chapman Vaginal Electrode should be used.

This instrument is introduced edge-ways into the vagina and, after insertion, is rotated into position (Fig. 1A). When properly applied it automatically engages the cervix within the cervical bowl and elevates and supports the uterus, while the vulva closes over the insulated vulval groove and helps to hold it in position. These factors are of practical importance as all other types of vaginal electrodes will work out of the vagina during treatment. The knees are flexed and widely separated while the electrode is being inserted, but the legs are extended during the treatment, the attachment cord from the vaginal electrode passing down between them to one of the binding posts of the D'Arsonval connection.

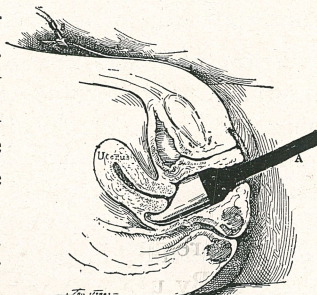


Fig. 1A—Insertion of Chapman Electrode.

Precautions in Applying Electrodes

The vaginal electrode should be lubricated with glycerine, K-Y jelly, or liquid soap for introduction into the vagina. The surface underneath external electrodes should be shaved and the skin and under surface of the electrode coated with soap lather. The umbilical depression underneath the indifferent electrode should be filled with liquid soap and all electrodes applied snugly. Failure to observe these factors will cause a variation of from five to ten degrees in the heating effects obtained within the tissues and make for the success or failure of a valuable therapeutic agent.

Gynecology, Diathermy in—Continued The Indifferent Electrodes

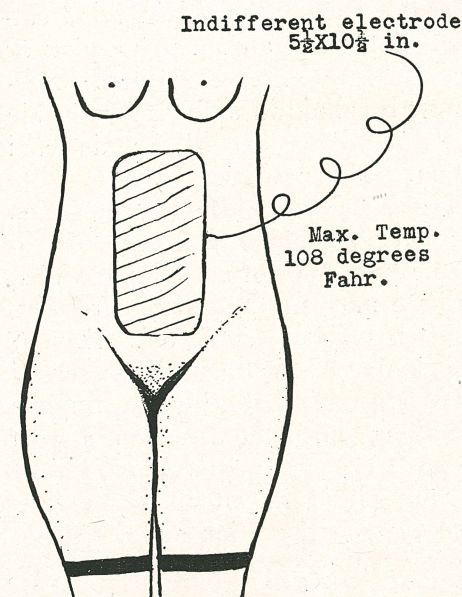


Fig. 2. Large indifferent electrode.

The application of the indifferent electrode is almost as important as that of the active or treating electrode. Fig. 2 shows the type of electrode that may be used and its proper location. This electrode is of block-tin and is $5\frac{1}{2} \times 10\frac{1}{2}$ inches in size. It will allow an elevation of temperature inside the vagina of 108 degrees F., which is sufficient to se-

cure the required therapeutic effects. By using an extremely large indifferent electrode as in Fig. 3, intra-vaginal temperatures of from 110 to 113 degrees F., may be obtained. It has been found, however, that tissue necrosis is threatened by temperatures around 112-115 degrees F., and we do not recommend temperatures above 110 F., for general treatments.

Very large block tin or mesh indifferent electrode. $12 \times 14\frac{1}{2}$ in.
Max. Temp.
110 plus degrees Fahrenheit.

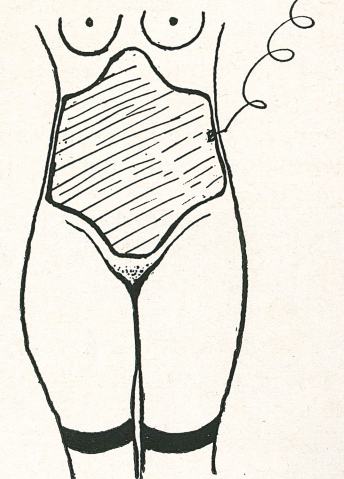


Fig. 3.—Extra large indifferent electrode.

Gynecology, Diathermy in—Continued

Contra-indications to Treatment

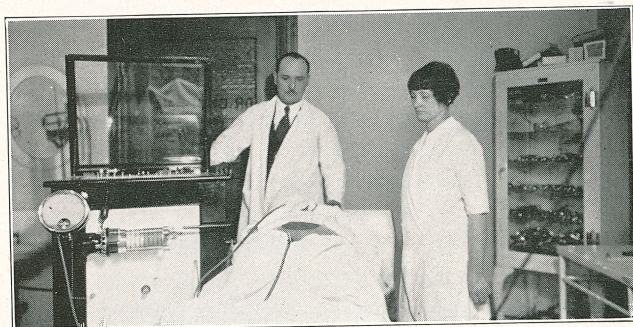
Where there is an enclosed abscess within the pelvis, this treatment should not be used. Chief of these is an old pyosalpinx or an abscess in the cul-de-sac of Douglas. Either of these conditions if treated by diathermy may break down and rupture inside the peritoneal cavity. These conditions should be detected by a careful pelvic examination. The palpation of a mass to either side of the uterus, or even a rigidity with slight deviation of the uterus to one side or the other, combined with some tenderness on pressure, should make one suspicious of an old pyosalpinx and if diathermy is used at all we must proceed very carefully, as one normal treatment will often suffice to set it off. Even if there is no pus present at the beginning of treatment the increased heat to the infected area will cause a rapid breaking down of the devitalized tissue with pus formation, and if the direction of least resistance is towards the peritoneal cavity it will rupture into it with a consequent peritonitis with all of its attendant dangers. In the event of this, the only recourse is operation and drainage.

Pregnancy and ectopic gestation are also contra-indications for the use of diathermy.

Treatment of New Growths

Surgical diathermy or endothermy is of extreme value in the removal of neoplasms of the female organs, many of which show a tendency to malignant degeneration. The technic is the same as for the treatment of neoplasms elsewhere and is described under the head of Surgical Diathermy.

The illustration below shows a typical Diathermy treatment of the type mentioned on page 33. Indifferent electrode is applied to the abdomen, active electrode inserted in the vagina, with the electrical cord extending downward be-



tween the patient's knees as mentioned in the description of the technic. Cord thus aids in holding bowl of electrode firmly against cervix.

Headache

Massage gently with vacuum electrode and mild current until relief is obtained. Migraine and severe headaches will require the addition of anodynes. Direct diathermy laterally thru the head may be tried. Negative galvanism over the forehead.

Hemorrhoids

W. B. Chapman, M. D., describes his technic as follows:

During the past three years I have performed quite a number of hemorrhoidal operations by surgical diathermy or electro-coagulation, and the success that has been attained convinces me that in the majority of cases this is the operation of choice.

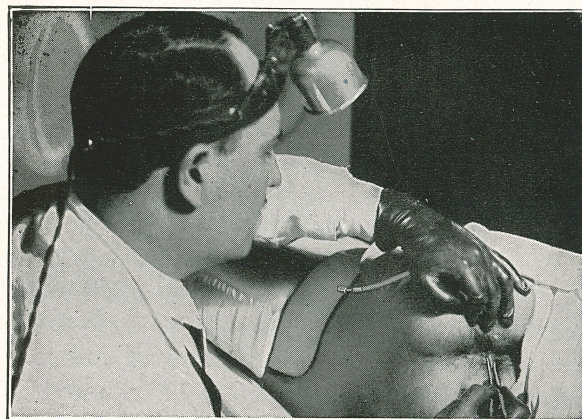
Cleanse the field and paint over with tincture of iodine. If the hemorrhoid is inside the rectum, it may be exposed in a woman by inserting a finger inside the vagina and exerting pressure on the rectum. If a man, the cup and suction apparatus of the high frequency machine is quite effective. A good rectal dilating speculum will also secure good exposure. When the pile is exposed, grasp it with the thumb forceps (Fig. 1, p. 60) and, using a 2 per cent novocain-adrenalin solution, inject a few drops underneath the tumor (Fig 2, p. 60). The thumb forceps should be rubber-tipped to prevent pinching. I usually cut short lengths from an old rubber catheter and slip over the ends of an ordinary tissue forceps.

For the operating instrument a sharpened Plank needle is very good. Any kind of a needle will do, but I employ the short pointed electrode that comes with the Diathermy operating set. This becomes the active electrode of the D'Arsonval circuit while for the indifferent electrode I employ a large piece of block-tin which is warmed and held in place by sand-bags. No soap lather is required for contact and it makes little difference where it is applied. It is also possible to use the auto-condensation pad or handle as the indifferent electrode, but requires much more current and the results are not so uniformly satisfactory.

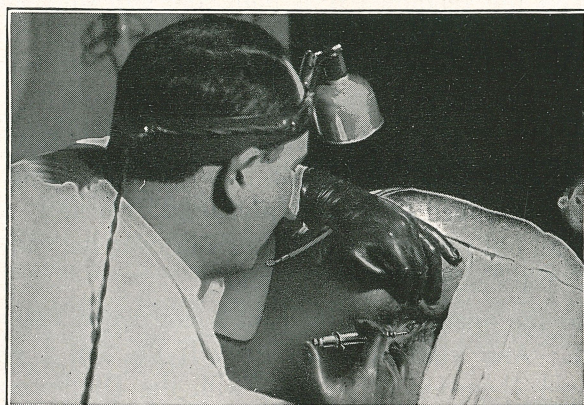
Using a high frequency machine at the lowest tension, set the controls so that the meter will read about two thousand milliamperes when the two electrodes are brought into contact with each other. With the current adjusted, the tumor anesthetized, and the indifferent electrode in place, insert the point of the operating needle into the pile and, using the foot-switch, apply the current

(Continued on Page 60)

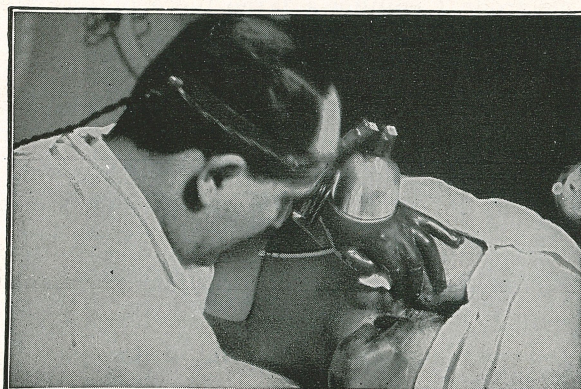
Hemorrhoids—Continued



Exposing
the pile
by means
of thumb
Forceps



Injecting
the
anesthetic



Coagulating
the pile
by means
of the
needle
electrode

Hemorrhoids—Continued

until the pile turns a steel-grayish color (Fig. 3, p. 60). This only requires a few seconds. The injection solution inside the pile becomes boiling hot and by scalding destroys the endothelial lining of the dilated blood-vessel causing a coagulation and consequent disappearance of the tumor by absorption.

Hemorrhoidal tabs or "sentinel piles" are largely fibrous tissue and should be coagulated until white. They separate after about ten days and the base heals over with a soft, pliable scar. After coagulation, the hemorrhoids will protrude from the rectum and should be bathed twice daily or oftener with hot boric or cresol solution. This limits the swelling, prevents infection, and relieves pain and soreness.

If there is much after-pain prescribe a suppository of cocoa-butter containing one grain of opium and from $\frac{1}{2}$ to 2 grains of belladonna. These suppositories are on the market and can be secured from any druggist on prescription. Instruct the patient to insert one suppository into the rectum on retiring, and they may be used as often as is required to ease pain. An ointment containing morphine sulphate gr. 5, tannic acid gr. 10, in one ounce of zinc oxide is also useful.

By the above procedure it is possible to treat successfully any case of piles and the patient may proceed about his daily work. It is best to coagulate only one tumor each time, the patient returning for another treatment, as soon as the soreness from the last is gone. The unfortunate thing about the treatment of hemorrhoids by surgical diathermy is that, especially, inexperienced operators will overtreat and produce so much tissue destruction at one time that the patient is completely incapacitated for several days.

Three or four treatments usually suffice to clean-up even severe cases, as the coagulation of one tumor often impairs the blood-supply to several other hemorrhoids, causing them to disappear also; I have in mind a case where one treatment cured a case of hemorrhoids that was so bad that the man was incapacitated from earning a livelihood and was confined to his bed a large portion of the time.

Another thing, with this operation, there is not the danger of hemorrhage, embolism, or infection that attends the old operative procedures, and the end-results are more satisfactory.

Hip Joint Disease

See Tuberculosis of The Hip, page 89.

Hyperemia, Cerebral

See Cerebral Hyperemia, page 43.

Hypertension

Obviously the first essential in the treatment of hypertension, is to discover and eliminate, one by one, *all* the causes of the condition.

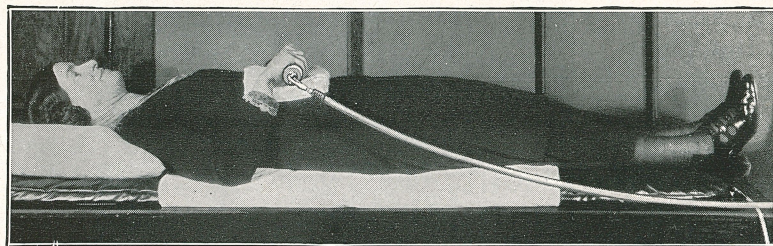
Corrective measures having been taken to eliminate the causes, auto-condensation is the method of choice in the treatment of hypertension.

Auto-condensation promotes an increase of tissue changes and an improved metabolism, with a resultant increase in elimination and removal of the basic cause of the patient's condition. Treatment, 600 M. A. 20 to 30 minutes daily or three times a week, according to the patient's reaction.

It will be seen that the general rule applying to all therapeutic methods—that treatment must be preceded by careful, thorough and complete diagnosis—finds no exception in the physiotherapeutic treatment of hypertension.

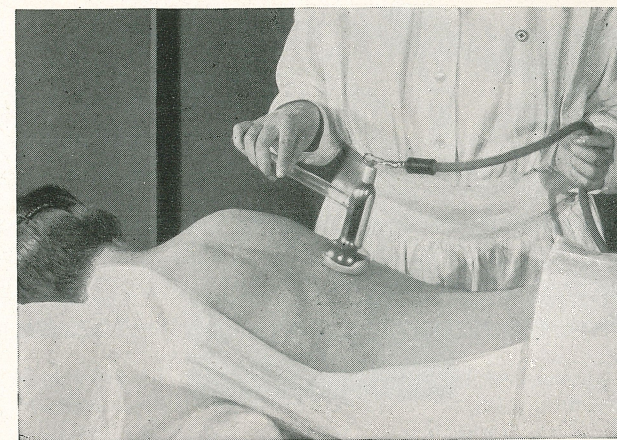
Grover says: "The patient should be treated daily until the systolic pressure reaches the same point with each treatment. This will be the point of compensation for that individual. This is the point known as *fixed tension* or point of compensation, and it will be impossible further to reduce the pressure. Auto-condensation cannot impair cardiac sufficiency. When the point of fixed tension is found the frequency of treatments is so regulated that this point may be maintained."

Contraindications, valvular heart disease, nephritis.



Patient lying on auto-condensation pad and holding auto-condensation handle in hands.

Hysteria



Application of high-frequency electrode in hysteria.

Give massage to spine using surface electrode and $\frac{1}{4}$ inch spark. Treat for fifteen minutes moving the electrode slowly up and down the spine. If the patient does not respond, try raising the electrode from the surface and give several sharp sparks to the skin. Illustration shows application of electrode.

Intercostal Neuralgia

Diathermy is indicated to relieve the pain and promote a healthy hyperemia. Place electrodes where indicated and treat for thirty minutes. Skin tolerance.

Iritis, Acute or Chronic

Vacuum or non-vacuum electrodes or metal electrodes may be used in the treatment of iritis. Treat for 30 minutes, using low milliamperage. Approved methods are described on page 46.

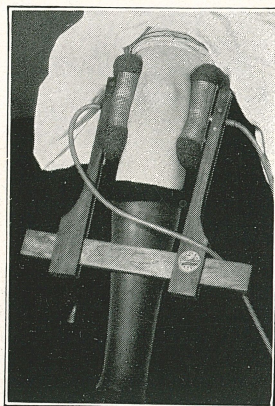
Indirect Diathermy Treatment: Place patient on the auto-condensation pad and connect it to the Tesla post and apply indirect Diathermy, using fingers of the operator for the active electrode.

Keloid

These fibrous growths are easily removed by surgical diathermy, but will recur unless the x-ray or radium is used to prevent it. For technic, see section on Benign Skin Blemishes, pp. 82 to 84.

Small Keloids will disappear after prolonged use of the vacuum electrode with the current taken from the Tesla post.

Knee Joint Injuries



Application of diathermy clamp and sponge mesh electrodes to knee.

Treatment should be begun as soon as possible after the injury occurs, before edema and swelling have taken place. To be sure, these conditions are by no means a contra-indication for diathermy treatment, but if they can be forestalled, much pain and trouble may be avoided.

Even when the X-ray shows the presence of a fracture diathermy treatment is indicated.

Be careful, in applying the electrodes, to use a bandage that will not become tight as the limb swells. Free circulation is essential.

Employ the diathermy treatment, as described below and on the following pages, at frequent intervals until the edema and swelling have been checked or abated, which may take 36 to 48 hours.

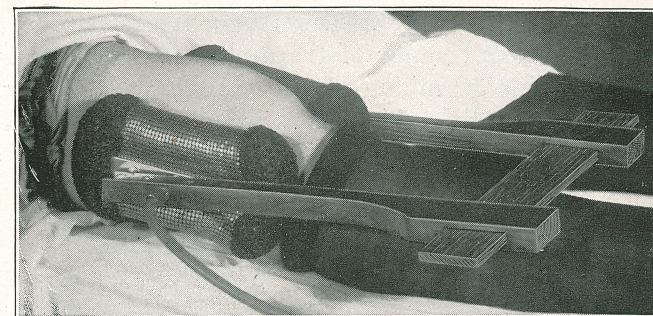
The joint may then be bandaged in the usual manner, and the patient will experience a minimum of pain and inconvenience during convalescence.

Value of Sinusoidal Treatment in Knee Joint Injuries

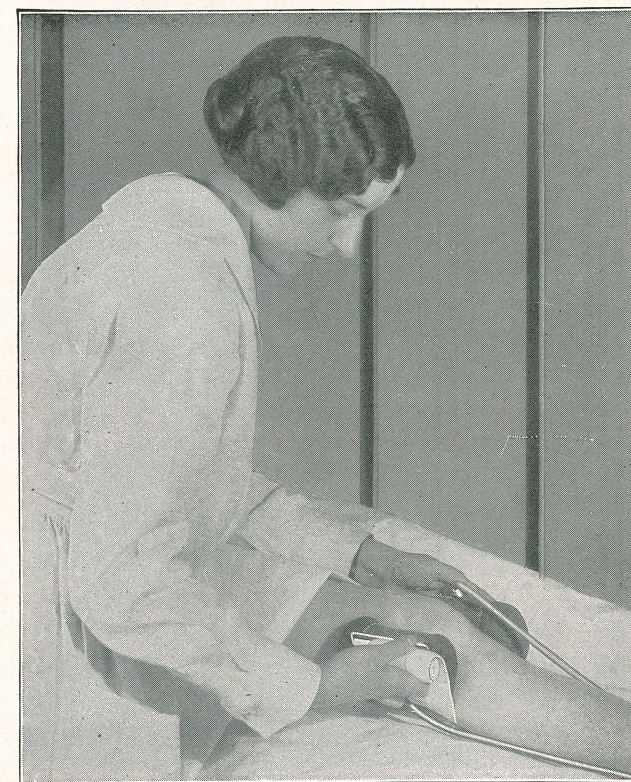
Three or four days later, sinusoidal treatment may be begun, applying electrodes above and below the bandages and using very light stimulation at first, until healing is well under way. In this manner, fibrosis, ankylosis and muscular atrophy are avoided.

Even in cases first seen several weeks or months after the injury, sinusoidal treatment combined with massage and manipulation will be found of distinct value, as will diathermic heat, applied before treatment to relax the parts.

Knee Joint Injuries—Continued



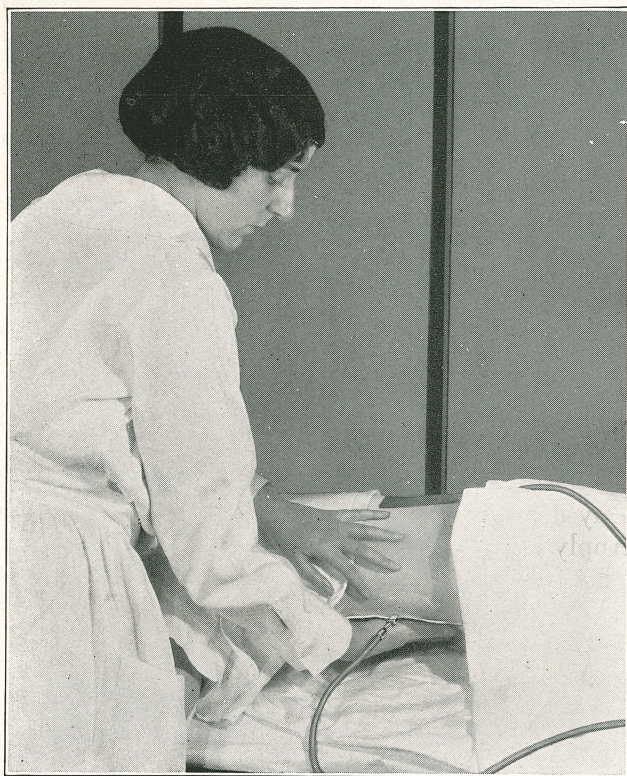
Above:—Mesh covered sponge electrodes applied to knee by means of Diathermy Clamp. 800 to 1200 milliamperes for 20 minutes.



Mesh sponge electrodes applied to either side of the knee and held in place by elastic bandage. Mesh $4\frac{1}{2} \times 3$ in. Give 800 to 1200 milliamperes for 20 minutes.

Laryngitis

Indirect Diathermy may be used with excellent results, the fingers of the operator being used as the active electrode. The fingers conform to the contour of the neck more easily than any electrode. Treat for 30 minutes. This condition is best treated some times, superficially, with a non-vacuum electrode over the larynx. Time, 10 minutes daily. Diathermy is especially effective in acute infectious laryngitis.



Lumbago

The illustration shows the large tin plate electrode slipped into place under the lumbar region, the other electrode on abdomen; treat for 30 minutes, 1800 to 2500 milliamperes, tolerance of patient.

Leukocythemia

See Anemia, page 28.

Leukorrhea

See section on Diathermy in Gynecology, pp. 55 to 58.

Lymphadenitis

Diathermy is of value in the treatment of lymphadenitis. When the inflammation is not very active, physicians often attempt to abort the process by cold applications or by painting the swollen glands with the tincture of iodine. If this fails, or if the glands are actively inflamed, they may be broken down by diathermy, (heat) with the formation of pus, which should be evacuated. Apply an electrode slightly larger than the inflamed gland with a very large inactive electrode on the opposite side of the body. Treat twice daily for 45 minutes, until the inflammation subsides and resolution is established. If suppuration occurs the pus must be evacuated.

Menopause, Neurotic Symptoms of

These symptoms are due to some effect, not clearly understood, of the interrelated system of endocrine glands on the autonomic nervous system. Auto-condensation will give as valuable a sedative effect in this condition as in hypertension, the two being closely related.

Menstruation, Irregular

See Diathermy in Gynecology, pp. 55 to 58.

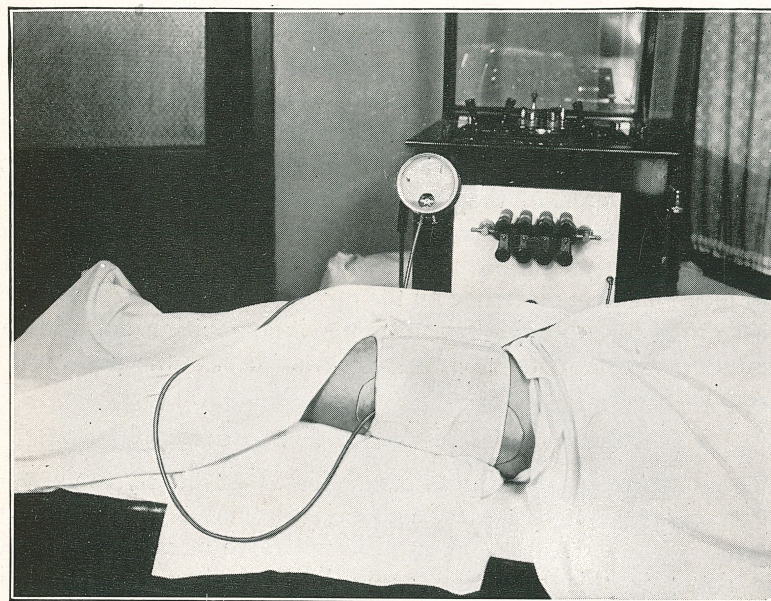
Migraine

Diathermy is often very useful in this exceedingly painful condition. Apply small electrodes, or use the fingers for treating about the head at the points of exit of the sensory nerves. Give treatments daily. When the attack is on, only strong anodynes will give any relief. Use a mild current and treat 20 minutes daily.

Myocarditis

In the light of our present knowledge of the pathology of myocarditis—that of impaired nutrition—diathermy may be accepted as a rational therapeutic agent. Numerous favorable reports have been received from physicians who have used diathermy in this condition. Almost immediate relief may be expected from the precordial pain or angina, if present, and a general feeling of relief is experienced following the treatment.

Treatment: 1,000 to 1,200 ma, 4 in. x 5 in. electrodes front and back, 30 minutes daily. Absolute rest in bed at beginning, followed later with graduated exercises.



Myositis

Above is shown application of electrodes for treating traumatic myositis of the extensor muscles of thigh. (*Charlie Horse.*)

Electrodes should be placed slightly more anteriorly than shown in the illustration so as to produce greatest heat in the extensor muscles.

Nerve Injuries, Peripheral

Diathermy should be given until nerve regeneration is complete. Apply block tin or mesh electrodes so as to include the affected nerve between them. When regeneration is complete, cease diathermy, as it obtunds the sensitiveness of the nerve to galvanism.

Then use the slow reversing galvanic sinusoidal through the limb from the spine to the extremity; one or two waves per second of an intensity one-fourth of that required to produce muscle contraction on the healthy side for 10 to 15 minutes daily.

Each day, just after the above treatment, stimulate the individual affected muscles, one electrode at the end of each muscle, one impulse per second. Give each muscle three contractions each day. (The muscle will not respond to motor points at this stage.)

When regeneration is complete and motor points reappear, exercise the muscle by motor point stimulation.

Then give passive, finally active motion.

Neuralgia

All forms of neuralgia respond readily to diathermic measures. Apply electrodes to include affected area between them, using two large block tin or mesh electrodes. Technic as in Arthritis, pp. 8, 9. Treat as often and as long as is required to relieve the pain, and at the same time seek the cause and treat it by whatever measures indicated. Focal infections such as are found in the tonsils and around diseased teeth should receive attention. Trigeminal neuralgia will usually require, in addition to diathermy, some opiate to relieve the pain.

Neuritis

In all cases of neuritis whether it be of the toxic, traumatic, chronic, interstitial or exudative type, there is some edema and swelling of the nerve itself.

This, together with more or less degeneration which follows, is productive of pain and various paresthesias associated.

The sensory symptoms may be mild or severe, depending upon the extent of the inflammation and degeneration. The degenerative process may extend from the periphery upward involving the spinal cord, or even the brain.

Diathermy is of distinct value in relieving the edema and swelling and consequently preventing the pain, also in hastening the absorption of any exudate and assisting resolution by producing a marked hyperemia of the parts treated, all of which favors repair.

In chronic cases the static wave current alternated with diathermy is of value to remove infiltrations and exudates.

Neuritis, Brachial

Medical diathermy. Note that position of posterior electrode is over the lower (4th, 5th, 6th, 7th and 8th) cervical and upper dorsal vertebrae, while the anterior electrode is placed well to the outer side of chest and over upper part of arm. The current then traverses region occupied by brachial plexus. Treat for 20 to 30 minutes, with from 500 to 1000 milliamperes, according to patient's condition and tolerance.

Neuritis, Ulnar Nerve



Above:—Application of electrodes for brachial neuritis. Note that position of posterior electrode is over the lower (4th, 5th, 6th, 7th and 8th cervical and upper dorsal vertebrae) while anterior electrode is placed well to outer side of chest and over upper part of arm. Current therefore traverses region occupied by brachial plexus. Treat for 20 to 30 minutes, with 500 to 1000 milliamperes, according to patient's condition and tolerance.

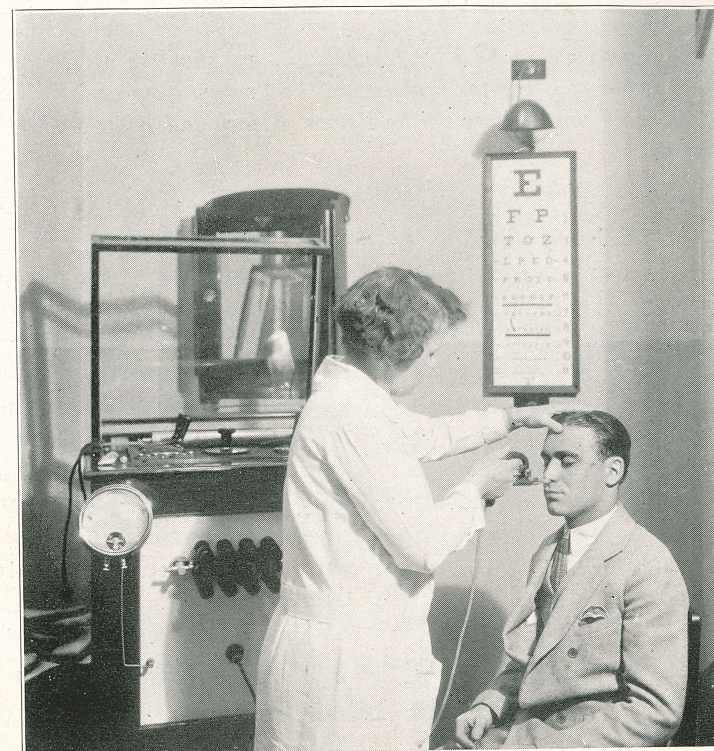


Non-Vacuum Electrode—See P. 47.

Nose, Diathermy to

At Left:—Treating nasal mucous membrane by indirect method. Patient is seated on the auto-condensation pad which is connected to the central binding-post (monopolar coil) of the Fischer High Frequency machine. Holding a nasal non-vacuum electrode in contact with the area to be treated, the operator applies the current. The current is then drawn from the patient's body through the electrode to the operator, who acts as a "ground" to the current.

Nose, Diathermy to—Continued



Above:—Monopolar diathermic treatment of nose. Special nasal electrode. Set for $\frac{1}{8}$ in. spark or less, treat for 10 to 15 minutes, each nasal chamber. This method of treatment has been used rather extensively in asthma and hay-fever, coryza, and all so-called "catarrhal" conditions of the nasal mucous membrane.

Onychia

Treat as constantly as practical until condition is overcome. The air-cooled ultra-violet lamp is used in conjunction with diathermy. Onychia is frequently a sign of systemic debility. The patient should be examined thoroughly from head to foot. Anemias, tuberculosis, severe infectious fevers, carcinoma, are frequent etiological factors.

Orchitis

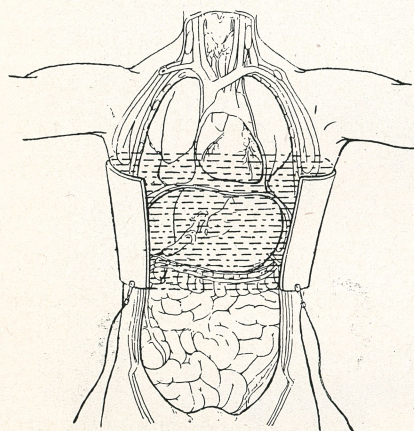
See epididymitis, page 48.

Osteomyelitis

See article on the treatment of tuberculous osteomyelitis, page 92, for technic. In acute streptococcic or staphylococcic osteomyelitis, drainage must be established as quickly as possible. Diathermy is extremely valuable in the treatment of these conditions.

Operations, Abdominal

Abstract of an article by G. W. Crile, M. D., on The Use of Diathermy and of the Quartz Lamp for Conserving the Temperature of the Viscera and Promoting the Welfare of the Patient Before and After Abdominal Operations.



Above illustration shows effect of Diathermy current as used for "heating through" the entire field during an abdominal operation, according to Dr. Crile's method.

It was apparent to Dr. Crile that the only satisfactory method of preserving the normal temperature of the liver during operation would be by the employment of some system which would "heat through" the tissues, more particularly the liver, without unduly affecting the outside surface. The principles of diathermy at once suggested themselves.

Diathermy, which consists of the passing of a current of high frequency through the body of the patient, has the

property of heating the subcutaneous tissues without affecting the external parts in contact with the electrodes of the apparatus. Dr. Crile felt that if one of the diathermy electrodes were placed upon the lower chest on one side and the other electrode brought opposite the dome of the liver, then the current would pass through the upper abdominal organs, including the liver. Now, if this current could be continuously applied throughout the operation, the temperature of both liver and abdominal viscera in general would be maintained at or above the normal, regardless of the exposure of the intestines.

Dr. Crile also points out that on account of the enormous spread of the capillaries, veins and arteries very near the surface of the viscera, the blood in the whole splanchnic area almost immediately assumes the temperature of the air to which it was exposed. By the

passing of the diathermy current through the liver and the neighboring viscera, this thin layer of blood would, as it were, be made to pass over a hot table so that warm blood would pass into the rest of the circulation.

In accordance with this conception, Dr. Crile and his associates have been applying the diathermy current in certain bad risk cases. They have found that the electrodes can be put in place and the diathermy current established before the abdominal incision is made and that neither the surgeon nor the patient need be aware that such a current is passing. By actual observation it has been found that the temperature of the dome of the liver can be maintained above normal throughout an extensive operation in which the abdominal viscera are widely exposed.

In Feeble and Aged Patients it has been observed that a higher incidence of pneumonia takes place following abdominal operations than after operations of an equal magnitude on other parts of the body.

As a possible explanation of this occurrence, Dr. Crile advances the theory that cooling of the liver results in a general depressed function of the organism together with cooling of the blood in the important organs within the chest wall. He and his associates are, therefore, now noting the effects of diathermy in lessening the incidence of post-operative pneumonia.

In feeble and aged patients after especially wide and prolonged exposure of the upper abdomen, repeated doses of diathermy are delivered through the bases of the lungs. In addition to the advantage of heat to the part, the increased temperature must tend to bring about a more active circulation in this area and thus increase the natural defense against infection.

Otitis Media

In acute otitis media radiant heat-light is the agent which affords relief and often aborts complications. Diathermy should not be applied in acute cases in which drainage has not been effected. After paracentesis or spontaneous rupture of the drum membrane, diathermy is of great value. A small block tin electrode, cut so as to fit over the ear and mastoid on the affected side, and a large indifferent electrode over the face on the opposite side, may be employed as an improvised method. Diathermy may be administered through the ear canals, but this method is of doubtful value. The method of choice involves the use of the head band and special electrodes. Treatments should be given for 20 to 30 minutes; between 250 and 300 milliamperes are sufficient, and treatments may be repeated once every twenty-four hours. This same method is of decided value in chronic catarrhal otitis media where the opening in the drum membrane is of sufficient size to permit good drainage. In acute cases, radiant heat-light should be used between the intervals of diathermy treatments.

Ovarian Neuralgia and Ovaritis

Diathermy is indicated for relief of the pain. For technic, see section on Diathermy in Gynecology, pp. 55 to 58.

Ozena

See Nasal Catarrh, p. 43.

Periostitis

Diathermy is effective in the treatment of this condition. Give daily treatments of thirty to sixty minutes duration. Treat to skin tolerance. Apply large block tin or mesh electrodes to include affected parts between them.

Pharyngitis

Pharyngitis sometimes yields to the application of diathermy locally to the neck. This can be performed with vacuum or non-vacuum electrode. The ideal treatment, however, is to irradiate the pharyngeal cavity with ultra-violet light from the water-cooled lamp, using suitable quartz applicators.

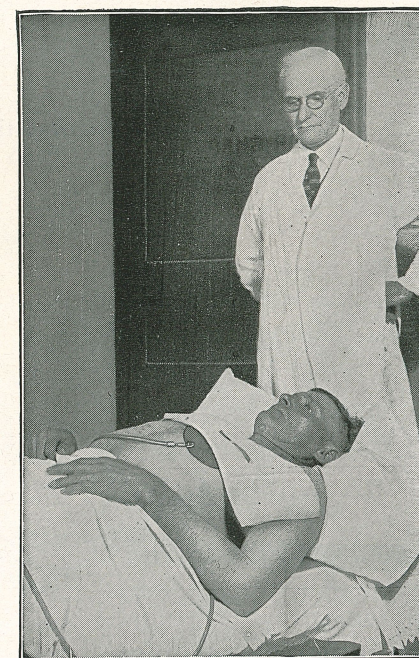
Pleurisy

In this disease, as in pneumonia, diathermy treatment directly *through* the affected area is used. Excellent results have been attained in the various types of pleurisy, relief of pain and dyspnea being afforded by each treatment. Technic is similar to that used in the treatment of pneumonia. Two large mesh electrodes, or tin plate electrodes, are so placed as to include the affected area between them. In applying the electrodes, use sufficient warm soap lather to insure perfect contact, and warm the electrodes before applying to the skin.

The current is turned on gradually and raised to the point of tolerance, remaining at that point from twenty to thirty minutes, then gradually turned off. Milliamperage will be from 1700 to 2000 at the maximum, although in some cases less may be sufficient.

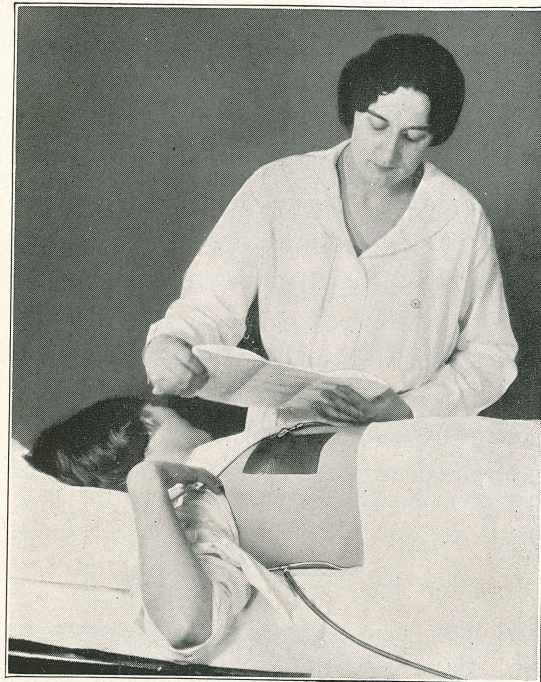
Where there is marked effusion diathermy may be employed after proper drainage has been established. It must be borne in mind that the heat produced within the affected tissues themselves by diathermy, promotes increased metabolism. Diathermy should be an aid to the absorption of the effusion.

Care must be taken to prevent the electrodes from slipping or becoming detached during the treatment, which would cause sparking and might burn the patient's skin. Do not depend on the weight of the patient to hold the posterior electrode in place. A firm elastic bandage will ensure perfect contact of both electrodes.



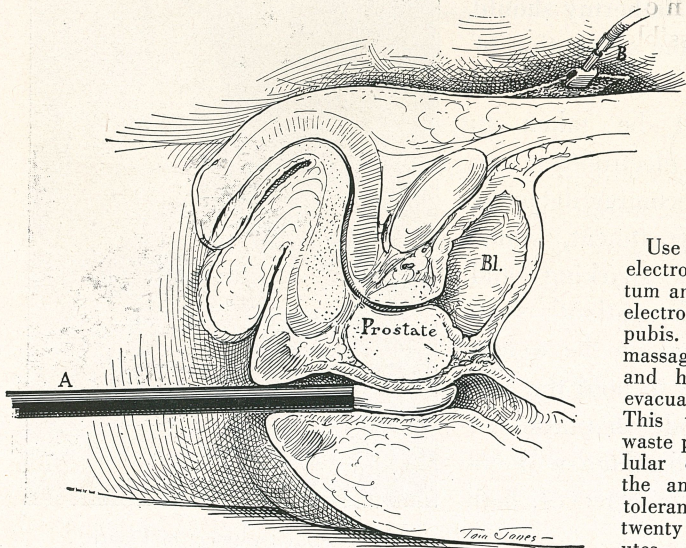
Diathermy treatment of Pleurisy.

Pleurisy—Continued



Electrodes being placed for treatment of right lung area; other plate under back.

Prostatitis



Use special prostatic electrode in the rectum and the indifferent electrode over the pubis. After treatment massage the prostate and have the patient evacuate the bladder. This washes out all waste products and cellular debris. Elevate the amperage to skin tolerance and treat twenty or thirty minutes.

Pneumonia

Harry Eaton Stewart, M. D., reported: "In every single case and almost every single treatment the temporary effect upon the patients was remarkable. Cyanosis disappeared, the expiratory grunt when present was markedly lessened or stopped entirely. Respirations were less labored and the patient received from two to four hours of very marked relief, in many cases obtaining sound sleep. . . . It is not too much to assume that in many critical cases this marked relief of symptoms may be the turning point in disease. Under proper technique there is no danger of ill effects from two or even three diathermy treatments per day."

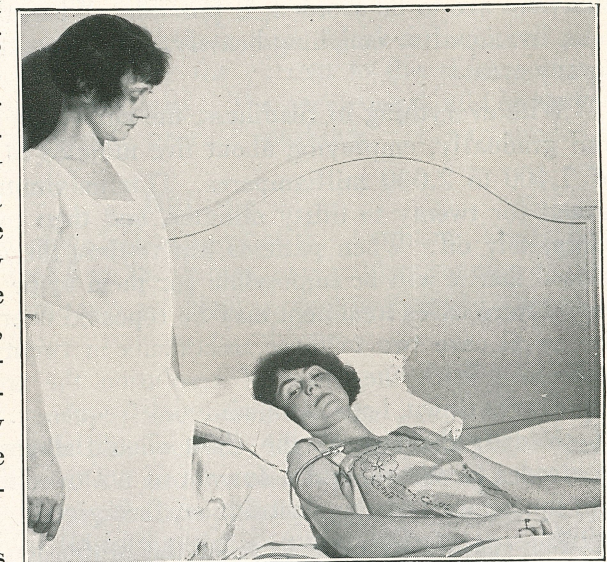
While it is accepted as a fact by many physicians that pneumonia runs its course uninfluenced by medicine, the results obtained by those using diathermy indicate that during the first stage congestion may be dissipated by this treatment, and that the second and third stages can be very favorably influenced by its application.

Dr. Stewart adds, regarding technic:

"The development of the portable diathermy apparatus to a very high degree of efficiency makes it possible for the physician, today, to give accurate and effective diathermy treatments in the home of the patient.

"Diathermy is given by means of a portable apparatus supplied with a milliamperemeter and capable of delivering 2,000 milliamperes of current.

"For electrodes we usually employ the flexible composition metal, 22 gauge, cut in convenient sizes with edges turned over and rolled flat. For use over a single lobe plates about 5 by 7



Diathermy treatment of Pneumonia.

Pneumonia—Continued

inches, applied to the chest and back, are convenient. In treating two adjacent lobes, one lung, or both bases, we use larger electrodes, which will include the involved area. When it is necessary to treat two non-adjacent lobes, plates of the size for a single lobe treatment are employed and two separate applications of the current are given. The anterior electrode may be of flexible chain material when there is any great irregularity in the contour of the chest. The preparation of the electrodes consists in warming them thoroughly and covering them with hot soap lather before applying them to the skin. The posterior electrode, clipped to the cord, is placed on a folded bath towel, the mattress depressed, and the electrode slid under the patient to its proper position without disturbing him. An additional towel or small pillow may then be crowded under it to insure good contact. The chest electrode may be gently held in place by the tips of the operator's fingers or secured with adhesive strips. Sand or shot bags and circular constrictions are to be avoided, if possible. When the patient is restless, irrational or coughing heavily, good contact must be secured in any event.

"With everything in readiness, the current is turned on slowly and gradually, employing about five minutes to reach maximum of 1,400 to 2,000 milliamperes. This maximum may be maintained for twenty to thirty minutes, and then turned slowly and completely off. When patients are restless the cords must be so placed that it will be impossible for them to be pulled loose. In very severe cases treatment may be repeated every four hours. In the usual case two to three treatments in twenty-four hours are sufficient. With the onset of resolution the treatments can be rapidly cut down, both in amount and frequency. In the treatment of children the size of the chest should determine the proper electrodes to choose, and a current of not over fifty milliamperes per square inch of the electrode surface given.

"The cumulative experience of the profession in the treatment of this disease has taught caution in placing faith in any one method of treatment. Innumerable methods have been tried and discarded in an attempt to lower the heavy mortality incident to lobar pneumonia.

"Clinical investigation of the effect of diathermy in lobar pneumonia offers certain advantages. Among these are:

"a. It is available wherever electricity is installed.

Pneumonia—Continued

"b. It requires no cumbersome or very expensive apparatus.

"c. The technique of its application while exacting is neither very difficult nor complicated.

"d. Not a single untoward effect has followed the giving of some 1,900 treatments reported to date. We may therefore feel assured that, properly given, it is absolutely safe.

"e. No other part of the entire treatment regime of the patient, even including the use of serum, need be postponed or contraindicated when diathermy is employed.

"f. Unlike certain other medical and surgical procedures, it has not proved its value almost wholly in the hands of one individual or institution. The writer is glad to acknowledge that a number of his co-workers have obtained a lower mortality in the treatment of their cases than he has in his own. He feels certain that what they have done may be equalled or surpassed by the Profession at large."

Proctitis

Apply mesh-sponge to anus with large block-tin or mesh electrode over abdomen. Elevate the current to the skin tolerance and treat for thirty minutes daily. The perineum should be shaved and soap lather applied to prevent sparking. This treatment is quite effective.

Rhinitis

Diathermy is of value in treatment of this condition. For technic see pp. 70, 71. Treat 5 to 15 minutes, using either vacuum or non-vacuum electrode and only sufficient current to produce a sense of warmth in the inflamed mucous membrane.

Sacro-Iliac Arthritis

Diathermy treatment is effective. Use large block tin or mesh electrode under hips and a similar electrode on the anterior surface above. See page 89 for application of electrodes. Treat at skin tolerance for thirty minutes or more, daily or twice daily.

Salpingitis

See Diathermy in Gynecology, pp. 55 to 58.

Scars

Painful scars may be treated by diathermy. For application of electrodes, see Adhesions, p. 27.

Sciatica

Diathermy affords great relief in this extremely painful condition. The current may be passed anteroposteriorly through the upper part of the nerve by putting one electrode over the sacro-sciatic notch and the other directly opposite it on the anterior surface. Or, it may be passed down the nerve with one electrode over the sacro sciatic notch and the other a cuff below the lowest point of pain on the leg. Treat at skin tolerance for at least thirty minutes daily or twice daily. If the pain extends the full length of the leg, treat in sections. The custom of placing one electrode against the hip and another on the ankle or sole of the foot is to be condemned as the resistance of the great amount of tissue to be traversed reduces the diathermic effects to a degree where no benefit is derived from the treatment. For application of electrodes see page 89.

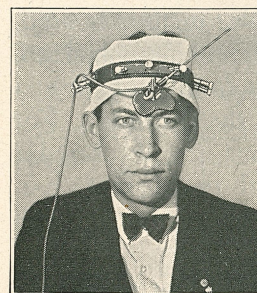
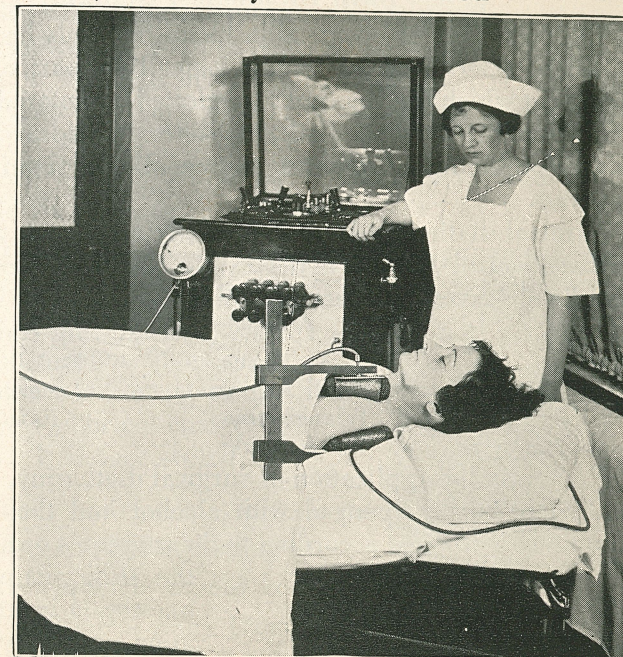


Shoulder, Diathermy to

At Right—4x6 inch block tin electrode is placed under shoulder, large mesh sponge electrode above, held in place by sand bag.

Shoulder, Diathermy to—Continued

At Right—Diathermy clamp application of double mesh sponge electrodes to shoulder for concentrated heat treatment. 300 to 400 milliamperes, patient's tolerance, for 20 minutes.



Applying diathermy to frontal sinus by means of headband.



Applying diathermy to antrum.

Sinus Infection

Drainage is the first essential. This may be established surgically by shrinkage, or by the use of positive galvanism, using a probe wound with a little cotton and dipped in 1-1,000 solution of adrenalin hydrochloride. Insert the probe, attach to the positive pole of the galvanic current and connect the negative to a large indifferent electrode on the cheek. About three milliamperes of current is used, for five minutes. The current is then turned off slowly and the probe removed. The pus and mucus will come out on suction then, as a rule. This may be followed by diathermy, with one electrode in contact with the supra-orbital region, and the indifferent electrode on the nape of the neck. Treat for 20 minutes.

Skin Blemishes, Benign

The treatment of benign skin blemishes includes a wide variety of minor operations which are logically a part of the surgeon's work, but which frequently are neglected or ignored by the general practitioner. Surgical diathermy offers the ideal means of treatment, combining in greatest degree all the requirements of the operator.

Surgical diathermy is applied easily and quickly, is under such perfect control that even the eyelid may be operated safely, is bloodless, leaves the least possible scar and calls for little after-treatment. It is suitable for all the following conditions:

Moles	Spider Nevus	Boils
Warts	Small Angiomata	Localized Skin Infections
Papillomata	Telangiectases	
Sebaceous Cysts	Tattoo Marks	

Preceding the application of surgical diathermy, the skin should be first carefully sponged with alcohol and then dried. Local anesthesia is utilized according to the surgeon's own technique, and the skin again dried. After anesthesia is attained the operation proper is performed.

When the lesion is small, the monopolar method is used, with the current passing from the machine to the patient and thence to the ground. For larger lesions, use the bipolar method, with the current passing from the machine through the active electrode to the patient and thence through the inactive electrode back to the other pole of the machine. For the active electrode, a needle point electrode is used. For the inactive, the operator may use a large piece of block tin or mesh, affixed firmly to patient's back or chest; or the patient may hold the auto-condensation handle in his hands.

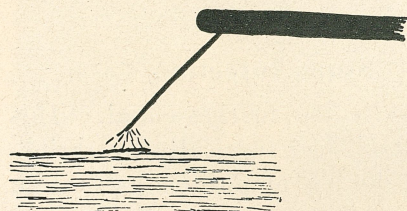


Fig. 1. Drawing showing the needle applicator held a short distance away from the skin, a shower of sparks passing to the lesion.

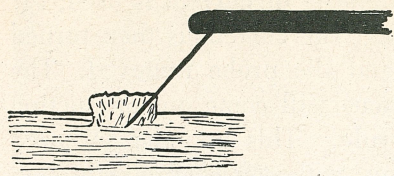
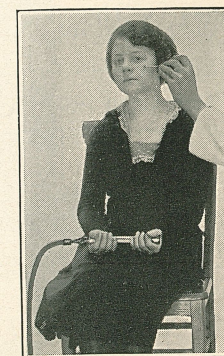


Fig. 2. Needle applicator inserted into lesion. Multiple punctures such as this are made until entire base is coagulated.

Skin Blemishes, Benign—Continued

An excellent method of dealing with these small skin lesions is to grasp the lesion in a pair of artery forceps which is connected to one of the d'Arsonval terminals, and plunge into it a needle connected to the other terminal. Thus the current and its destructive effect are confined to the portion held by the forceps, and do not extend into undesired areas.

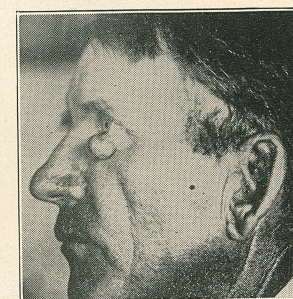
At Right:—Unipolar current used for removal of benign skin blemish where the latter is very small. Patient holds auto-condensation handle in hands. Operator uses small needle electrode with just sufficient current to produce spark. Use foot switch for instant control.



When the lesion is small and superficial, the needle electrode should be held about one millimeter away from the skin, allowing the current to spark across from the electrode to the lesion. The electrode should be moved about to avoid the danger of leaving pits where deeper destruction is effected. (Fig. 1, p. 82.)

Where the lesions involve the deeper layer of the skin, as in warts, it is preferable to push the needle into the tissue at one point at the base and coagulate, repeating this process until the entire wart has been treated. (Fig. 2, p. 82.)

For small lesions, no dressing is necessary and the patient may wash the face as usual. If an exudate occurs under the coagulated tissue it should be drained.



Sebaceous cyst arising from the lower eyelid near the margin. Successfully removed by surgical diathermy.

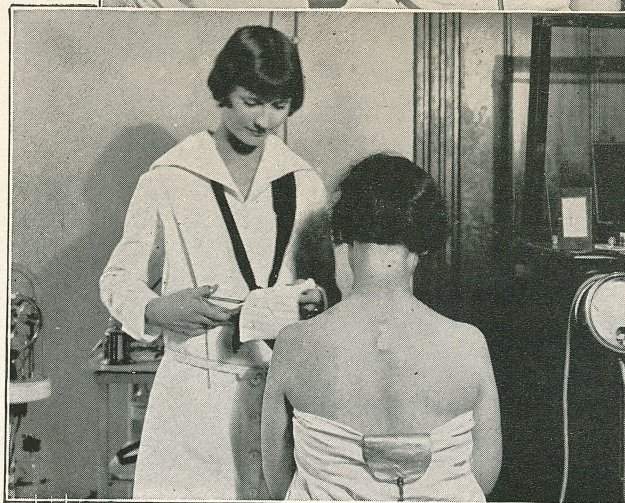
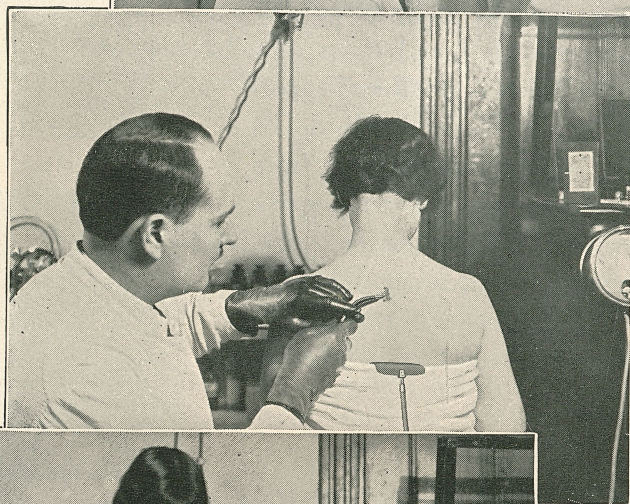
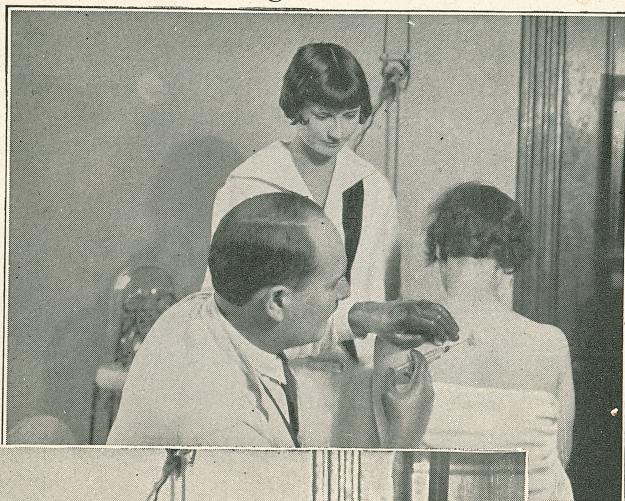


Multiple warts on palms of both hands. Successfully removed by surgical diathermy.

Skin Blemishes, Benign—Continued

Right: Injecting local anesthetic.

Center: Coagulating with the needle-point electrode.



Left: Coagulated area after operation is completed.

Sprains

Diathermy is quite useful in the treatment of sprains, it relieves the pain, hastens absorption, accelerates repair. For application of electrodes, see section on the part to be treated: wrist, ankle, elbow, etc.

Supra-Orbital Neuralgia

Diathermy is often very useful in this condition. Apply small electrodes, or use the fingers for treating at the points of exit of the sensory nerves. Use a mild current, and treat for twenty minutes daily. Supra-orbital neuralgia may be caused by a rhinitis or sinusitis.



Tic Douloureux

Above:—Block tin indifferent electrode, shaped to under side of face. Active electrode is disc, held by operator. Toleration milliamperage for 15 minutes.

Tonsils

Physiotherapists who use the electrical modalities in tonsil infections claim a degree of success equal to that achieved in tonsillectomies, together with greater ease of operation and less discomfort to the patient. The diathermy operation is bloodless, the diseased parts are sterilized because the current used is germicidal, and singing and speaking voices are not impaired.

The edema which follows the electrical operation may be held to a minimum by care in operation. The patient may often go about his business the next day, and the after-soreness, which is slight, will disappear within a very few days.

Two different methods may be employed to advantage in the destruction of tonsil tissue, fulguration and coagulation. In addition, medical diathermy, the application of heat to the affected tonsil by means of the high frequency current, may be used to advantage in certain types of tonsillitis, notably in fibrous and in hypertrophic tonsils.

Local anesthesia is used by most surgeons in the tonsil operation by diathermy—ether would be dangerous because of the possibility of an explosion. In some cases, no anesthetic is required. The local anesthetic may be swabbed over the surface of the tonsil or injected, depending on the nature of the case and the preference of the operator.

A number of special electrodes have been devised for use in tonsil operations, and one of these should be properly selected in the diathermic operation, since both operator and patient will experience better satisfaction through the use of correct instruments.

It is possible, in using diathermy for tonsil operations, to perform part of the operation and then wait until the resulting slough has come off before operating upon the remainder of the tonsil. This method has two distinct advantages. First, it makes the operation a comparatively easy one for both surgeon and patient, since each application of diathermy requires but a few minutes. Secondly it frequently is found, after partial operation, that the remaining tonsil tissue will return to normal under the germicidal influence of the current used in the operation.

Tonsil Treatment

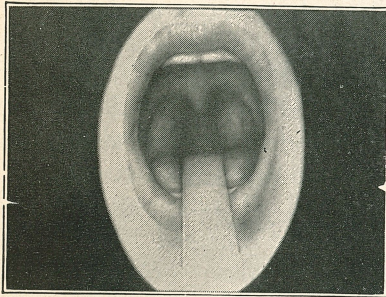
FULGURATION. The hollow glass electrode is used, affording regulation of the intensity and direction of the sparks. The tonsil is prepared for operation by anesthetizing according to the surgeon's preference. The electrode is then applied directly to the tonsil, with a large indifferent electrode in the dorsal region, or with the patient holding the auto-condensation handle. A foot switch is used, and current turned on and off as the surface of the tonsil is covered. The operation may be repeated at intervals of a few days until complete recovery results. For the after soreness, an epsom salt gargle is recommended by some surgeons.

ELECTRO-COAGULATION. The needle electrode is used, with a large indifferent electrode in the dorsal region or auto-condensation handle in patient's hands. After anesthetizing the tonsil, the needle is inserted into the surface of the tonsil about one-eighth of an inch and the current turned on by a foot switch. Leave the current on only until the tissue around the electrode turns a grayish white — coagulation only being desired, and not an actual charring of the tissues. Repeat this until the desired area has been covered. The resulting slough will come away within a week or ten days. Epsom salt gargle may be used for after-soreness, and epsom salt compresses if there is marked edema.

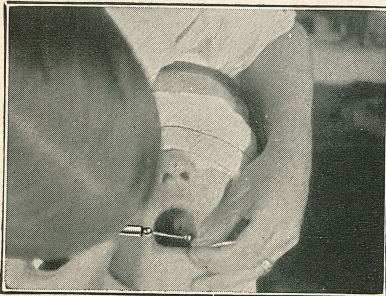


Electro-coagulation of tonsils.

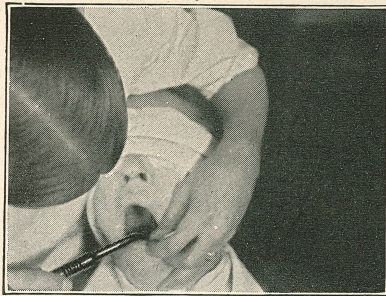
Electro-Coagulation Treatment of Tonsils



1. Showing diseased tonsils exposed for treatment.



2. Injecting the anesthetic into the tonsil.



3. Inserting the electrode into the tonsil.

Note: In electrocoagulating the tonsil, be very careful not to carry the treatment too far. The moment the area around the needle shows grayish in color, the current should be switched off. This is important, as excessive coagulation will cause edema.

At Left: Steps in the electro-coagulation treatment of tonsils.

According to some surgeons, the advantages of surgical diathermy over other methods are:

Little surgical shock.

No danger of embolism.

Little danger of hemorrhage.

No danger of metastatic infection or toxic absorption.

Complete sterilization.

No contracting cicatrix.

No open wound to become secondarily infected.

Torticollis, Acute

Diathermy is very useful in acute torticollis. Alternate deep diathermic applications with surface massage using the vacuum electrode.

Tuberculosis of the Hip

Hip joint disease may nearly always be taken as an indication that tuberculous foci of infection exist elsewhere in the system. Some physicians hold that tuberculosis never is present anywhere in the body without a concurrent—or previous—infection of the lungs. Naturally, before an improvement of the hip lesion can be effected, these other focal sources of infection must be located and eliminated.

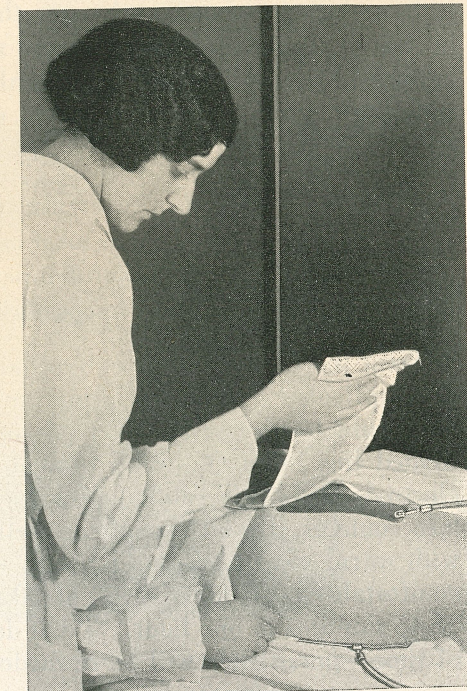
Diet, fresh air and sunlight—all the usual physiotherapeutic measures—must be combined with local treatment. If there is pus present, as is quite likely to be the case, drainage may or may not be instituted. Patience is required in the treatment of this condition, both on the part of the physician and the patient.

Along with diathermy treatment, quartz lamp radiation of the entire body, (the artificial sunlight treatment), is of benefit in this disease, as in all tuberculous affections.

These diathermic treatments help the tuberculous lesion by direct action. Attenuation of the bacilli is produced by the excessive temperature, furthermore, the heat automatically produces a vasodilation of the arterioles and venules with a great influx of freshly oxygenated blood to the part, as well as a concentration of the bactericidal enzymes of the blood, with a raising of the opsonic index. The vascular disturbance attracts leucocytes; phagocytic activity is increased and the infection stamped out. The heat and the healthy hyperemia favor repair. Fibroblasts are stimulated, disintegration products are absorbed, the calcium content of the tissues is raised and healing proceeds.

Diathermy Treatment:

Block tin electrode 4x7 in. is applied posteriorly as shown. Anteriorly, use either block tin (shaped to body surface) or mesh electrode, same size, held in place by sand bag.



Tuberculosis, Pulmonary

Physiotherapy treatment in early pulmonary tuberculosis is of decided benefit if used with judgment in conjunction with the classic therapy of this disease. In no sense should diathermy be used alone, supplanting the excellent results obtained by the combination of rest, proper food, fresh air and sunlight, but rather supplementing these measures. Contributory causes—as infected tonsils—must of necessity receive attention. Indiscriminate use of diathermy must be avoided unless the operator has a clear mental picture of the diseased area. Confined pus is an absolute contraindication and while the danger of hemorrhage has been over-emphasized it is well to proceed with extreme caution in those cases with symptoms of hemorrhage.

The object sought in the use of this current is an acceleration of the natural action of the bodily forces fighting the disease rather than any destructive effect on the tubercle bacilli themselves. However, by relieving the area of venous stasis about the tubercle and replacing it with a fresh oxygenated blood supply which, as well as blood chemistry changes themselves, tend to inhibit the growth of the tubercle bacillus and render an otherwise favorable cultural location untenable. Locally all of nature's forces of repair are stimulated, the tubercle more firmly walled off, liberated toxins eliminated or broken up.

For a few days following treatment the symptoms increase, followed by a decrease of expectoration, cough, increase of appetite, improvement of color, lower temperature, gain in weight and a feeling of well-being very encouraging to the patient.

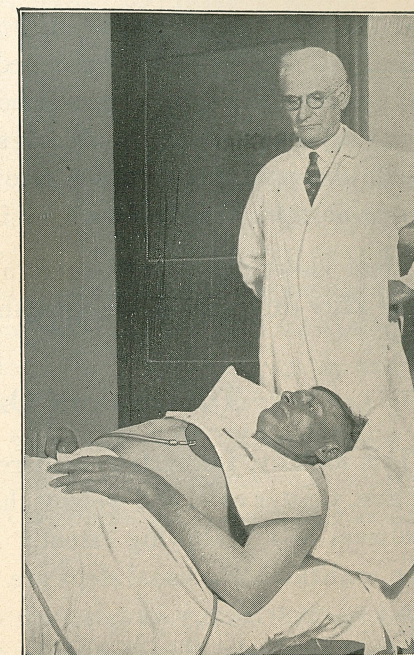
Treat the patient as an individual. Tuberculosis is seldom an uncomplicated disease. Technic must be adapted to fit the case. As a rule use block tin electrodes so placed that the area to be treated lies between. With patient in prone position, the upper electrode had best be weighted down by a small sand bag to maintain contact. The electrodes as well as the skin must be coated with warm soap lather. Maintain what to the patient is a good comfortable heat for a period of 20 minutes at first, up to seances of 45 minutes to one hour. Treat daily—and over a long period of time—persistence will be rewarded.

Tuberculosis, Pulmonary—Continued

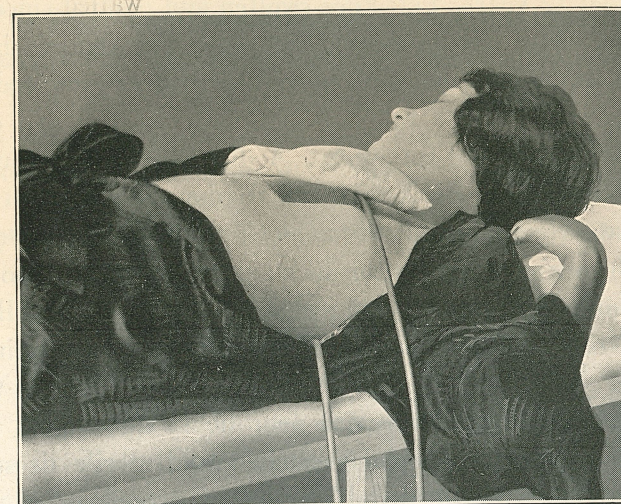
In the far-advanced cases, while little can be done to influence the final result, diathermy will make the patients much more comfortable both to themselves and families through the amelioration of symptoms.

Results are more striking if the diathermy treatments are followed by properly controlled applications of ultra-violet light.

Illustration at right shows application of chest electrode for lesion in apex of left lung.



Pulmonary Tuberculosis



Application of electrodes in Pulmonary Tuberculosis.

Tuberculous Glands

Tubercular adenitis, if seen before suppuration has taken place, and the gland and adjacent tissues have broken down, can frequently be aborted by the combined use of X-rays locally, and the ultra violet ray given as general body radiations. If suppuration occurs or has occurred, the abscess should be aspirated, passing the needle through healthy tissue into the pus pocket, to avoid producing an open wound and mixed infection.

Ultra violet ray is invaluable in these cases. Diathermy is of value after drainage, either spontaneous or induced, has occurred.

Tuberculous Osteomyelitis

This malady, formerly considered as a case for surgical intervention, plaster casts and weights, has yielded to physiotherapeutic treatment to a gratifying extent. Naturally, after diagnosis has been confirmed, the usual steps are taken to regulate diet, elimination and contributory causes such as tuberculous infections elsewhere in the body. The diathermy treatment is perhaps best illustrated by quoting a typical case:

Patient aged 12 years. Left knee swollen and painful since two years of age. At times quiescent, but never reduced in size to normal, and on the least exposure to cold, or if over-exercised, the knee would swell, become red and extremely painful and child would be confined to bed for weeks. A diagnosis of tuberculosis of the bone was made by X-ray, and diathermy treatment prescribed. Plate electrodes cut from block tin and shaped to the contour of the leg were applied on each side of the swollen portion of the leg and held in place by an elastic bandage. 1500 milliamperes of current was passed through the leg for thirty minutes each day for six treatments. A red spot appeared after the third diathermy treatment which became necrotic in the center. This was lanced, a quantity of pus evacuated and sterile dressings applied until the sinus healed. The above procedure is regularly employed at this clinic in the treatment of bone tuberculosis.

Turbinates, Hypertrophied

Anesthetize the mucous membrane and, using a pointed electrode, reduce the turbinate by electro-surgical coagulation. For technic, see surgical diathermy.

Butyn 2% or cocaine 1% with adrenalin is applied locally on cotton as a tampon for 5 minutes. A diathermy plate, 3x6 inches, is now applied to the back of the neck and attached to the indifferent terminal by an insulated cord. A second cord is attached to the medium voltage pole and the other end in the holder of the Applicator. The current is now tested out by shorting the Applicator upon the indifferent pole. The rheostat set on 1, and the fine adjustment on the condenser should be set with a fine spark so that the milliamperemeter will read 400. Now advance the rheostat to the 2nd and 3rd button so the milliamperemeter registers about 1200 or 1500. This will give you a high milliampereage with a low voltage.

Separate the nasal alae with a nasal speculum and apply the Applicator to the affected turbinate, flatwise with gentle but firm pressure, keeping away from the septum.

With finger or foot switch (preferably the finger switch), test the patient out with one or two short flashes. If tolerated without pain hold the current on for about five seconds. One application to an area is sufficient. Then move above or below or posteriorly as the size of the turbinate may require and repeat the application.

Upon the second day the mucous membrane becomes swollen and congested but from the third day on for two weeks the membrane gradually shrinks until a free air passage is obtained. The after treatment consists of a douche or wash with normal salt solution and every other day swab out the nasal passage with 10% argyrol solution; and thus observing the patient, you will note a gradual atrophy of the thickened membrane taking place and your patient will tell you he breathes better and has more air space.

Ulcer, Duodenal

See Duodenal Ulcer, page 45.

Urethritis

For female, see section on Diathermy in Gynecology. In treating the male, see paragraph on Gonorrhea, pp. 53, 54.

Vaginismus

See Diathermy in Gynecology, pp. 55 to 58.

Vaginitis

See Diathermy in Gynecology, pp. 55 to 58.

Varicose Ulcers

Diathermy may be employed for relief of the pain, and to increase local nutrition and metabolism but compression and drainage of the engorged veins is essential.

Varicose Veins

See Varicose Ulcers, above.

Vesiculitis, Seminal

Apply mesh covered sponge electrode to anus or special prostatic electrode in the rectum inserted so as to come in contact with the vesicles of the two sides successively. Large block tin or mesh electrode over abdomen. The perineum should be shaved and soap lather applied to prevent sparking. Treat with bladder distended. After treatment, have the patient evacuate the bladder. This washes out all waste products and cellular debris. Elevate the amperage to the skin tolerance and treat twenty to thirty minutes. It is also possible to treat this condition with the special prostatic electrode, but the above procedure is more comfortable to the patient.

Warts

See Benign Skin Blemishes, pp. 82 to 84.

Wrist and Finger, Diathermy to

At Left:—Electrode on wrist, other in basin of water in which finger is immersed. 200 milliamperes for 20 minutes. Patient must be cautioned against lowering other fingers or hand into water or touching pan as a spark will be produced that is unpleasant, and always startles an inexperienced patient. The older patients learn to avoid this. (Chapman Clinic)



Wrist and Fingers, Diathermy to

At Right:—Mesh cuff electrode around wrist, hand resting on sponge in basin of water in which other electrode is immersed. Fingers are inserted in water to desired depth, to bring heat to affected joints. 500 milliamperes for 20 minutes.



Wrist, Diathermy to

At Right: — Mesh cuff electrode to wrist, hand immersed in basin of water containing other electrode. Heat is thus concentrated at wrist joint. 500 to 700 milliamperes for 20 minutes.



Wrist, Diathermy to

At Left: — Showing application of two sponge mesh electrodes one on either side of wrist, held in place by elastic bandage. Sponges are moistened and soaped lightly before applying. 600 milliamperes for 20 minutes.